Private International Cartels: Effectiveness, Welfare, and Anticartel Enforcement

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Abstract

This paper presents and analyses economic data on 167 international cartels that were discovered by antitrust authorities after January 1990. The median cartel had five corporate members and generated $1.2 billion in sales during the collusive period. Nearly 40% of affected sales occurred in the organic chemicals industries, half of which were sold to food, feed, and agricultural firms. On average, the cartels lasted nearly six years, but average durability declined by more than 60% from the early 1990s to the early 2000s. In the early 2000s more than 20 international cartels were discovered each year, a rate six times faster than the early 1990s. The large size and longevity of these cartels, when combined with average monopoly overcharges of 28%, cause a great deal of monetary harm to buyers.

Discovered cartels have met with increasingly harsh sanctions since 1990. Government authorities have imposed a total of $7.1 billion in fines on 870 companies and 62 executives, of which the United States (27%) and European Union (51%) are the major governments responsible. Private antitrust suits resulted in settlements totaling at least $3.4 billion. Some 32 executives have been imprisoned.

Statutory penalties, if imposed at maximum levels, would extract about 12 times cartel overcharges, a level sufficient to deter most firms from forming or joining a cartel. However, applying optimal deterrence concepts to the characteristics of modern international cartels allows one to deduce that current antitrust enforcement is inadequate to deter cartel formation. This conclusion follows from low probabilities of detection, overly generous leniency policies in fine-setting, the absence of private suits outside North America, the inability of most indirect purchasers to recover damages, and generally weak anti-cartel enforcement in Asia and Latin America.

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Introduction

The sudden discovery of a global pandemic of illegal international cartels in the mid 1990s, after a hiatus of a half century, is puzzling. This burst in cartel activity, which tended to begin in the 1980s, parallels the increase international trade and capital movements often called globalization (Rodrik 1998)[1]. That a high share of these cartels sells ingredients to the food and feed industries adds another element of mystery to the puzzle. Whatever the causes of this unexpected resurgence of global price fixing, the reaction of the antitrust-enforcement authorities has been fascinating. If the burst in illegal price fixing exposes one of the dark sides of globalization, the strong responses of antitrust agencies to the challenge of global cartels may be one of the bright aspects. This paper will address the effectiveness of anticartel enforcement worldwide.

The behavior of global cartelists has scandalized the public and provoked the world's major antitrust agencies to impose unprecedented sanctions. The executives of these companies engaged in overt communications (including face-to-face secret meetings) and made explicit agreements to control market prices and quantities sold. These are conspiracies among putatively antagonistic rival suppliers intended to defraud customers by disabling normal competitive market forces. In the antitrust literature they are termed "hard-core" or "naked" cartels (OECD 2002)[2]. Beginning with the announcement of the U.S. investigation of the lysine cartel in July 1995, literally thousands of articles have appeared in newspapers and magazines around the world that have covered the machinations of more than 50 global cartels. Three books have been published on the subject, and two Hollywood movies have or will appear.[3]

A large share of the discovered international cartels explicitly fixed prices in multiple continents. These "global cartels" have become a major focus of antitrust agencies, which have imposed "titanic fines" ($2 billion by the United States and $3.6 billion by the European Union) that have "dwarfed" the actions taken against previously convicted price-fixing conspiracies.[4]

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[1] Rodrik (1998) and three accompanying articles show that data on globalization rates (relative to value added) for most high-income countries surpassed the rates of 1900-1913 by the 1970s or 1980s; the degree of globalization in the 1920s was also relatively high, but lower than pre-Word War I levels. These three periods also correspond to the three most intense periods of international cartel activity.

[2] Other kinds of cartels may be formed to establish industry technical standards, to impose trading rules to enhance market efficiency, to regulate commodity or financial exchanges, to support generic advertising campaigns, or engage in other forms of procompetitive behavior.

[3] Lieber 2000, Eichenwald 2000, and Connor (2001) are the books. The movies are *Anti-Trust* (directed and starring Tim Robbins) and *The Informant* (reported to be in production in late 2002 by director Steven Soderburg). It is notable that enforcement of a white-collar crime like price fixing could become a cinematic subject. It is difficult to imagine that the deliberations of a public service commission or any other type of economic regulation could achieve quite the same dramatic potential.

[4] Hammond (2001b), but many other antitrust experts echo his sentiments.

For decades prior to 1995, U.S. prosecution of foreign companies or persons for price fixing was practically unknown, but since then 50% to 70% of the companies indicted by the U.S. Department of Justice have been foreign; moreover, the DOJ has convicted cartel executives from 12 foreign countries, sending many to prison. Canada and the European Union also pursued aggressive anticartel policies from the late 1990s.[5]

International cartels successfully prosecuted by the U.S. DOJ have affected markets with more than $55 billion in sales (Kolasky 2002). This is an understatement. As explained in more detail below, the global sales of the international cartels in this paper's original data set are estimated to exceed $540 billion. The income transfers and social welfare losses generated by these international cartels may approach $140 billion.

Objective

The general purpose of this paper is to survey and analyze the economic dimensions of private (i.e., non-government supported) international cartels discovered since January 1990 and to assess the effectiveness of legal sanctions imposed on them by the world's principal antitrust agencies. In particular, information has been collected on the membership, durability, affected commerce, and direct-purchaser overcharges of 167 international cartels, many of which were global in scope. Some of these measures must be estimated from partial information. Durability and membership is available for the great majority of the cartel cases included in this study. Affected sales or overcharges are available for the majority of cases in at least one jurisdiction and in several cases multiple jurisdictions. These three characteristics positively correlate with the degree of economic injury engendered by cartel behavior.

This paper also has several specific sub-objectives. First, the data assembled will serve as a basis of future planned economic analyses of cartels. Information on the structure and behavior of cartels can be used to check on the validity of current theoretical models of overt collusion; moreover, empirical regularities in the data set can be used to identify "stylized facts" that guide the design of economic models of cartels yet to be developed. This paper explores why such a large proportion of these discovered cartels sold their products to buyers in two industry groups. The structure of cartel purchasers' markets is an enforcement screening factor rarely cited in the literature. The economic dimensions of the newest international cartels can be compared to those formed prior to World War I and in the interwar period of 1920-1940; such a comparison may reveal insights about the influence of broad historical conditions (degree of globalization, rigor of anticartel regimes, etc.) on cartel formation or effectiveness. Other quantitative analyses are planned to measure the determinants of cartel durability and overcharges.

Second, considerable effort has been devoted to collecting information on fines, settlements, and other cartel sanctions. These data are valuable simply as a way of charting new antitrust policies, but are also useful as elements in a variety of legal-economic analyses. For example, one can evaluate the government-imposed and (in the U.S. and Canada) private antitrust sanctions relative to the economic harm caused by these cartels. This analysis has important implications for the deterrence power of antitrust sanctions, many of which are based

[5] In 2000-2002, the EC fined 42 companies that were guilty of global price fixing, and 23 (55 percent) were non-EU firms.

on seemingly arbitrary rules of thumb: maximum government fines of 20% of affected sales (with culpability modifications) in the case of the United States, 10% of annual corporate sales in the EU case, and 6% of corporate sales in Japan.

Third, one can analyze the pattern of leniency discounting by the world's major antitrust agencies, which some writers have criticized as arbitrary, opaque, and unpredictable. Preliminary analysis of cross-jurisdiction antitrust fines shows a greater degree of consistency among the U.S., Canada, and EU than heretofore suspected.

Both the measures of sanction effectiveness and discounting practices have profound effects on the ability of public policies to deter cartels. A fourth sub-objective is to delve into the expected deterrence power of anticartel sanctions actually imposed since the mid-1990s.

Geographic Scope

All of the cartels analyzed in this paper are international schemes. I will adopt the definition of *international price-fixing agreements* employed by the DOJ since about 1995. In this context the term "international" will be reserved to describe a cartel's *membership composition.* That is, an international cartel is a conspiracy in restraint of trade that has or is alleged to have one or more corporate or individual participants with headquarters, residency, or nationality outside the jurisdiction of the investigating antitrust authority. The participants may be convicted parties or, at the investigation stage of enforcement, may be the subjects or targets of a formal probe. In practice, I have identified most of the cartels as international by using the country of registration of the parent companies participating in the cartel.

Focusing exclusively on international cartels is justified on several counts. Foremost is the fact that international cartels present prosecutors with distinctly greater challenges than purely domestic conspiracies. The difficulties of obtaining evidence and testimony from sources located abroad are well documented by failed prosecutions in the early 1990s; lack of cooperation from foreign governments and courts added to these difficulties. Another justification is the notably greater publicity given international cases by journalists and the antitrust authorities themselves; this ensures that information more likely to be complete for international cartels than for modest domestic actions. Finally, the economic harm caused by international collusion tends to be greater than localized conspiracies.

This paper further categorizes international cartels into three degrees of geographic spread, namely, *global*, *EU* and nation*al.* Global international cartels fixed or attempted to fix prices on at least two continents. Most of the "global" cases examined herein involve cartels that targeted markets in "the triad" of the most industrialized regions of the world – Western Europe, North America, and East Asia. At a minimum, the term global will be reserved for cartels that colluded across two or more of those continents. A large minority of the global cartels also conspired to fix prices in Africa, Latin America, Oceania, or other parts of Asia[6].

[6] A special category is ocean liner conferences, four of which have been fined by the EC. They are categorized as global because their rates affected commerce between Europe and one other continent.

The *EU-wide* cartels operate across two or more countries, but entirely within a single customs union, the European Union (EU). The EU is well along to becoming economically integrated into a single market and is beginning to resemble a unified sovereign state with a federal structure. More importantly, the EU has one of the most active competition agencies, the Competition Directorate of the European Commission of the European Communities (EC). In fact, the EC has antitrust jurisdiction not only the EU proper but also a group of states that are members of the European Free Trade Agreement (Norway, Iceland, Liechtenstein and, before they joined the EU, Finland, Sweden, and Austria). This expanded antitrust zone is called the European Economic Area.

Mario Monti, EC Commissioner for the competition directorate, recognizes the distinction. In a speech about his unit's anti-cartel activity in 2001, he said: "Some of the cartels were genuinely international, such as the vitamins cartel, while others affected only the European market" (Monti 2002:1).

The *national* category contains the smallest cartels in a geographic sense, those few that had international representation but that operated in Asia, North America, or Europe and almost solely within a single national border[7]. Although a rather awkward phrasing, these cartels may be thought of as "domestic" international cartels.

Categorizing cartels according to their geographic locus of operation is usually straight forward. The corporate members of global cartels subject to U.S., Canadian, or EU prosecution usually are identified as such by the press releases or reports of the prosecuting authorities. Joint raids or publicly revealed investigations by two or more of the major antitrust agencies are further indicators of probable global scope. In a small number of cases, the composition of the cartel allows one to infer how widespread the cartel operated. However, a few cartel cases required judgment about their categories that more information might require reclassifying them.

The *EU-wide* cartels are signaled by the involvement of the EC as the prosecuting unit, because the EC is usually required to establish significant effects on trade between the Member States in order to investigate a potential violation.[8] However, the reverse is not true. Member States of the EU typically prosecute only nation-wide cartels with negligible cross-border effects, but their competition authorities *may* prosecute international cartels under EU law as well. The 2003 prawns-fishing case in the Netherlands is the first example of this type.

The *national* category has the largest number of international cartels, more than half of the total number. With a few exceptions, these are cartels prosecuted or investigated by European or North American national agencies for price fixing in only one nation. It is possible that as more information becomes available some of these cases may require reclassification as EU-wide or global cartels.

[7] A few "NAFTA" cartels that operated in both Canada and the United States are placed in this category.

[8] The vitamin B4 cartels are a case in point. Three North American manufacturers agreed to cease exporting to Europe, and three European companies reciprocated. All six met once, but thereafter operated separately as far as is known. I treat them as two conspiracies, one centered in the NAFTA area and one EU-wide.

Time Period

This paper samples international cartels that have been "discovered" because they were sanctioned or are likely to be sanctioned for a price fixing violation from January 1990 forward. By sanctioned is meant pleaded guilty, were judged guilty by a court of law or a commission, were indicted and are awaiting trial, were fined by an antitrust authority, or agreed to pay a civil settlement. In a few cases, initial decisions made in the 1980s were appealed, with final decisions not issued until the 1990s. Cartels officially under investigation by a public antitrust authority are considered to be likely to be sanctioned because so few investigations fail to result in a fine or indictment[9].

The year 1990 marks the first year that the current U.S. fine structure for antitrust violations was fully in place. The present corporate leniency policy was adopted in 1993, and tougher investigative techniques were initiated in the early 1990s. This more assertive U.S. anticartel regime led to higher rates of discovery and prosecution of international cartels and was emulated in some respects by the Canadian and EU authorities. Monti (2002) dates the shift in EC enforcement priorities to 1998.

Product Categories

There are no industrial limits placed on the cartels in this paper's data set. However, certain tables found in this paper frequently distinguish *food and agricultural* products from all others. This category is broadly conceived to include food, animal feeds, and beverages as well as the inputs purchased by food manufacturers or by agricultural producers. Some writers refer to these vertically linked industries as the *food and agricultural system* (Marion *et al*. 1986). In the late 1990s the great majority of large-scale cartels that were discovered and prosecuted were part of this collection of food-related industries, though the relative importance of these types of cartels diminished somewhat after 1999. Some examples follow.[10]

Lysine is an essential amino acid, a building block of proteins that speed the development of muscle tissue in humans and animals. The form of lysine that we cartelized in the 1990s is a dry powder manufactured by a fermentation process and purchased by manufacturers of prepared animal feeds. *Citric acid* is an acidulant added to thousands of processed foods and beverages to enhance flavor and retard bacterial growth; a minor portion of industry output is used as an ingredient to replace phosphates in detergents. Citric acid is sold in two forms: a diluted aqueous form shipped in tanks and a dry salt form, usually sodium citrate. Since 1923, citric acid has been manufactured by a fermentation biotechnology. There are about 18 commercially important *vitamins* or pro-vitamins, proteins found naturally in foods that become catalysts in regulating the metabolic functions of humans and animals. Diets deficient in vitamins will cause diseases or functional impairments. Most bulk vitamins are sold primarily to feed manufacturers; food-grade vitamins are added to many processed foods and minor portions are sold to the

[9] The Danish beer investigation by the EC was dropped after several years because of lack of evidence about a conspiracy.

[10] A number of familiar food/agricultural products were cartelized: sugar, beer served in hotels and restaurants, private-label beer, beef, prawns, cigarettes, and infant formula.

pharmaceutical industry. Vitamins have been produced by synthetic chemistry since the early 1930s, and this is now the dominant method of manufacture.[11]

Brief mention is made of a few additional food-and-agricultural products that were cartelized in the 1990s. *Methionine* is an amino acid added to animal feeds, swine in particular. *Monosodium glutamate* (MSG) and *nucleotides* are amino acids that enhance flavors of foods. *Maltol*, *sodium erythorbate*, and *sorbates* are chemical food additives that flavor or preserve foods. *MCAA* (monochloroacetic acid) and *organic peroxides* are chemical intermediates used to produce pesticides. What is striking about these products is that each of them are *minor ingredients* or components of more complex mixtures further processed by large numbers of manufacturer-buyers. This characteristic helps facilitate collusion by ensuring highly inelastic demand. In addition, market price information is both poor for buyers and asymmetric.

There is a high degree of overlap between these food-and-agricultural ingredients and cartels that affected the markets of *organic chemicals* used as intermediate inputs by other manufacturers. Each of the 32 products just mentioned in the two paragraphs immediately above is an intermediate organic chemical. In addition, another 30 or so organic chemical intermediates were cartelized (see Appendix Table 1 for a list). All told, about one-third of the international cartels in this study were formed by manufacturers of organic chemical intermediates, which comprise by far the largest industry in the data set. These industries have a long history of involvement in international cartels (Stocking and Watkins 1946).

Other manufacturing industries that formed international cartels include finished pharmaceuticals, paints and some inorganic chemicals; paper products; cement and concrete; petroleum products; metals and metal products; and plastic and rubber products (Appendix Table 8). A number of cartels arose from a wide array of service industries: shipping; road and building construction; insurance; banking; and the distribution of petroleum products, to cite a few.

Organization

The following section offers a brief historical background to the phenomenon of international cartels. It also serves as a literature review that highlights some of the interesting issues in the treatment of international collusion by economists. The next section pulls together some generalizations about the relationship of cartel formation to market structure. The third section describes this paper's original data set: its sources, major features, and descriptive patterns. The fourth section analyzes the effectiveness of international cartels discovered in the past two decades or so[12]. The next section examines the anti-cartel measures taken by U.S, EU, and Canadian authorities, as well as private legal sanctions imposed by courts in the United States and Canada. These legal statistics feed into the paper's last substantive section, which considers the deterrence power of corporate sanctions.

[11] For more detailed information on the uses, technologies of production, and marketing channels for lysine, citric acid, and vitamins, see Chapters 4, 7, and 10 of Connor (2001).

[12] Previous empirical cross-sectional studies of discovered cartels offer statistics on a number of characteristics omitted in the present paper, such as trade association involvement, fixed costs relative to variable costs, the role of patents, disciplinary methods, exclusionary conduct, methods of policing agreements, and the social structures of the participants (Levenstein and Suslow 2002: Table 1).

Background

International private cartels are at least 125 years old. (Schröter 1999)[13]. The German-Swiss dyestuffs cartel that was established around 1880 is a prototype for the late 19th century international cartels. It was an amalgamation of two pre-existing national cartels that through predatory behavior against smaller producers in the UK, France, and Italy was able to ensure Western European dominance for its Swiss and German members. Word War I interrupted international cartels of this type, though most of them were re-established in the 1920s.

The interwar cartels were more ambitious in scope, often incorporating market-division or patent-pooling agreements with U.S. manufacturers that divided the Eastern hemisphere and the New World into two hegemonies (Hexner 1946, Stocking and Watkins 1946). The interwar cartels of 1920-1940 were nearly always based in the most industrialized countries of Western Europe. They adopted a wide variety of techniques to cartelize their home countries and international commodity trade. Besides agreements on prices and quantity shares for each member, patent pooling, common marketing agencies, and profit-sharing rules were common features of the interwar cartels. Asian and companies were almost never formal cartel members.

By this time the United States had an effective anticartel law, the Sherman Act of 1890 that made U.S producers wary of joining formal price-fixing agreements with European firms. In some cases, U.S. companies created subsidiaries that held the company's foreign assets, and these affiliates did join naked cartels. Many U.S. firms may have believed that cartel arrangements that merely created spheres of influence or involved patent-pooling agreements were legal under the Sherman Act, but events would prove them wrong. From 1946 to 1950, a crusading U.S. Attorney General made the criminal prosecution of scores of these interwar cartels his highest priority. Aided by public revulsion about the assistance given by these cartels to the rise of National Socialism and the rearming of Germany during 1933-1941, the U.S. government enjoyed a long string of successes in the courts (Wells 2002)[14]. The court victories apparently chilled the involvement of North American companies in international cartels for the next 40 years.[15]

Many of the international cartels discovered and prosecuted since 1995 are qualitatively different from those operating in the interwar period. A large number are truly *global* cartels and as such represent the ultimate product of the evolution of the cartel as a form of business enterprise.[16] Contemporary international cartels incorporate a refinement of operational

[13] Schroter traces the development of international cartels in Europe to the 1880's depression. Many cartels, such as the Hansa League and the Organization of Petroleum Exporting Countries (OPEC), operated under the protection of state sovereignty. Other commodity-stabilization cartels are effectively parastatal organizations. This paper discusses only cartels that are not sanctioned by law or protected by government agencies.

[14] This book also contains an excellent historical treatment of the international spread of the antitrust idea.

[15] The U.S. government attempted to prosecute only three global cartels during 1990-1996, but it was unsuccessful in court because of the difficulty of securing evidence and witnesses outside the United States (Connor 2001:66-69). The DOJ also secured guilty pleas from companies involved in six rather modest regional cartels in 1994 and 1995 (Appendix Table 3). The CCB convicted members of two regional cartels in 1990 and 1993. However, the 1996 convictions in the lysine cartel mark the beginning of the era of successful U.S. prosecution of *global* cartels.

[16] To be more precise, the global cartels of the 1990s had as their goal raising prices in at least North America, Western Europe, and Japan – a group called "the Triad" in the marketing management literature. Typically, these

techniques, a global perspective, a multicultural pluralism, a leadership style, a degree of longevity, and a scale of operation that the world has never before seen. Needless to say, global cartels are also the most injurious price fixing ventures yet devised, causing massive losses in market efficiency, losses in income for customers, and losses in faith in the honesty of businessmen[17] and the integrity of market institutions.

Market Structure[18]

The market environments for the lysine, citric acid, vitamins, and other global cartels discussed in this paper made possible and indeed fostered collusive price-fixing behavior by the leading firms in the industry. Two industry features tower above all the others in importance because they are necessary conditions for cartels to be formed and flourish: high seller market sales concentration and product homogeneity. High barriers to market entry permit cartels to be durable; without barriers new sellers will enter the industry and in time make cooperation in pricing infeasible. Commonly, when entry forces industry four-firm concentration to fall below about 65%, cartels fail. Entry is the most common reason for cartel failure (Levenstein and Suslow 2002:16). The remaining structural features of markets shown in Table 1 may be called "plus factors." The plus factors are not necessary conditions for the formation of cartels, but they do facilitate the establishment of price agreements and increase the probability of large, durable price effects.

Concentration on the Supply Side

There is no doubt that industry concentration – the share of sales or production capacity controlled by the leading suppliers – was high for every global cartel. The share of global production accounted for by the four largest manufacturers of lysine, citric acid, and vitamins A and E was in excess of 80 percent in the early 1990s.[19] Except for citric acid in Asia, sales concentrations within the continents were even higher than global concentration (Table 1).[20] There is evidence that Western Europe, North America, South America, and Asia were viewed by the cartels as geographically distinct markets. Prices were set systematically higher in Europe and lower in most parts of Asia, yet never so far apart as to allow non-cartel firms to make profits through geographic arbitrage.

Conceptually separate from the issue of overall industry concentration is the degree of supply control by the cartel itself. In most cases the top four or five producers were all members of the cartel, so in practical terms industry concentration and cartel control of supply were nearly the same. Another dimension of concentration is the fewness of company numbers. In the large

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cartels sought price control in all industrialized countries. Perhaps the interwar cartel that comes closest in scope and complexity to contemporary global cartels is the incandescent light bulb cartel (Stocking and Watkins 1946).

[17] I use this gender-laden term purposefully. Among the hundreds of businesspersons named as conspirators in the international global cartels I have studied, only one (the CEO of Sotheby's auction house) is a woman.

[18] General works on structural conditions facilitating collusion include Scherer and Ross (1990: 235-315), Tirole (1988: 239-270), Dick (1998), and Friedman (1977).

[19] In the few cases covered in Connor (2001) where entry caused industry four-firm concentration to dip below about 65 percent, cartel activity generally ceased.

[20] China was a fast-growing source for citric acid in the early 1990s; it also became a significant source for vitamin C and one or two other vitamins in the mid 1990s.

majority of cases, the global cartel operated with three to five corporate conspirators.[21] About 20 vitamin makers admitted colluding on prices, but when one looks at the *individual* vitamin markets (A, C, E, B1, etc.) no more than five firms were members of the cartel.

Buyer Concentration

Consistent with cartel theory, the degree of buyer concentration and the size of buyers faced by cartels were generally low. In eight out of ten well documented interwar international cartels, buyer concentration was low (Levenstein and Suslow 2002:Table12); in seven out of ten cases where buyer conduct was known, larger buyers tried to subvert a supplying cartel by backward vertical integration or trying to induce cheating. Buyers typically build up inventories during price wars and use or sell those inventories when a cartel is re-established. Occasionally, large buyers may assist the cartel in return for some of the cartel's profits.

In the case of food products, the buyers were thousands of feed manufacturers, food processors, or chemical wholesalers. In every instance, the top four direct purchasers accounted for less than 40 percent of the market, whether calculated at the global or regional level. Low buyer concentration makes it more difficult for purchasers to share credible information about transactions prices and prevents buyers from countervailing against the market power of sellers. Low buyer concentration may be one factor that accounts for the prevalence of global cartels in the food-and-feed-ingredient industries.

In the case of nonfood products, buyer concentration was sometimes at moderate to high levels. Some examples are graphite electrodes (sold to steel makers recycling scrap), carbon cathode black (aluminum smelters), parcel chemical tankers (chemical manufacturers), and holographic printing (credit card consortia). In these relatively few instances of high buyer concentration, it appears that the products that were cartelized formed a very small proportion of the total value of purchased inputs. Thus, even these presumably sophisticated buyers may not have had an efficient way of developing the expertise in their suppliers' industries sufficient to challenge unjustified price increases. Moreover, there are strategic reasons for leading companies in concentrated industries to overlook suspected cartel behavior by their suppliers (Levenstein and Suslow 2002). Many cartels make provisions for giving their largest customers (or any customer that had strong reason to complain) more favorable prices than smaller buyers, even in cases where cost savings of managing large accounts do not justify the discounts. The largest buyers then enjoy a cost advantage, however small, over their smaller rivals.

A substantial number of international cartels sold their products to government buyers and rigged the government tenders offers. The BT insecticide cartel sold its products to Canadian forestry departments, fuel suppliers to the military procurement agencies of Japan and Korea rigged their bids, and wine alcohol buyers allegedly rigged EU auctions. The great majority of government bid-rigging cases involved nonfood products: asphalt, bridges, marine heavy-lift transport, many public-works construction projects, distinct heating pipe, electric power equipment, petroleum fuels, and several cases of drugs and medical devices sold to health programs. The frequency and success of such bid-rigging schemes is often attributed to inept, uninformed, or compliant government procurement managers.

[21] The sorbates cartel and the sodium gluconate cartel each had six members (Connor 2002: Appendix Table A.2).

Table 1. Economic Conditions Facilitating Global Price Fixing: Lysine, Citric Acid, and Vitamin A, Early 1990s.

Market Conditions	Lysine	Citric Acid	Synthetic Vitamins A & E
High seller concentration:			
Global market	CR4 > 95%	CR4 > 80%	CR4 > 95%
U.S. market	CR4 > 97%	CR4 = 90%	CR4 = 100%
Few cartel participants	4 or 5	4 or 5	3
High cartel supply control	95-99%	65-70%b	95-100%
Low buyer concentration	CR4 < 30%	CR4 < 40%	CR4 < 20%
Homogeneous product [a]	Perfect	High	High
High barriers to market entry:			
Large plant scales	$150 mil. +	$150 mil.	Probably
Sunk investment costs	Yes	Yes	Yes
Technology secret	Yes	Yes	Yes
Building new plants slow	3 years+	3 years+	3 years+
Transparency of market prices to buyers	None	Some	Little
Large, infrequent transactions [d]	Yes	Yes	Yes
Major rivals have long history of strategic interaction	3 of 5	3 of 5	Yes [c]
Annual market growth	10%, steady	8%, steady	2-3%, steady
Price collapse triggers formation	Yes	Yes	Yes
Cultural propinquity of cartel members	Low	Moderate	High [b]

Sources: Chapters 4, 7, and 10 of Connor (2001).
CR4 = Sum of the market shares of the top four suppliers or buyers.
a Within well recognized industry grades when prices were at cartel-enhanced levels. There were no substitutes when prices were within a normal range.
b Control by formal members of the cartel. Cargill, a major supplier with up to 20 percent of U.S. capacity, provided passive support for the cartel's pricing decisions.
c The vitamin conspirators were long time rivals from Western Europe, but in most of the other vitamin cartels Japanese or Northern American companies had to be recruited to the cartels.
[d] Nearly all of the products were sold under annually negotiated supply contracts.

However, despite these cases of high buyer concentration, the great majority of nonfood cartels sold their products to dispersed private buyers, including consumers themselves. Among the many examples are cement, concrete, cartonboard, glass containers, auto refinishing paints, gasoline, mobile phone services, fax paper, music recordings, shipping services, and auditing services.

Homogeneity

Within normally observed price ranges, nearly all the products sold by the cartels included in the present study are perfectly homogeneous industrial goods. Where quality differences exist, accepted grades impose within-grade homogeneity. Chemicals are a good example of such goods. Vitamin A has a unique molecular structure, and no other vitamin can provide vitamin A's metabolic benefits. Yet, if the price of synthesized vitamin A is pushed up too high, then more costly vitamin A extracted from natural sources (e.g., cod livers) becomes price-competitive. If the rates for long distance ocean transport rise high enough, then land or air transport becomes an economical substitute.

There are very few consumer goods or services that have been cartelized, but these exceptional cases are instructive. The French beef and Dutch prawns cases involved graded, standardized products. A Belgian beer case concerned a collusive arrangement among brewers selling cans of beer that carried retailers' private label; the manufacturers were essentially bidding for the right to make an industrial product that was standardized by tight product specifications imposed by the buyers. The cell-phone rates cases involved consumer services that are not differentiated by perceived quality variation across providers. The main example of a cartel that involved a highly differentiated manufacturer's brand is the Italian cigarette case; in this instance, a duopoly continued a long historical practice of fixing the prices of Phillip Morris brands that had been legal so long as the state tobacco monopoly ETI had remained publicly regulated.[22] The antitrust suit applied only to the period after ETI was privatized.

Description of the Data Set

Data Sources

Data on the identity, economic dimensions, and legal actions of international cartels are drawn from many sources. First, most discovered cartels are first revealed to the public when fines, a guilty plea, or an indictment is announced in press releases of the DOJ, CCB, EC, or a dozen other national antitrust authorities with active anticartel programs. These are followed by additional documents, such as sentencing memorandums, plea agreements, "statements of fact" (in Canada), and official speeches of antitrust officials. In Europe the most important cartels have the full decisions of the EC (some of them running to more than a hundred pages) posted publicly about a year after the brief press releases about fines imposed or the closure of a case due to insufficient evidence. Lesser cases are described in the Competition Directorate's quarterly newsletter. All these documents are preserved on the web sites of the U.S., Canadian,

[22] The U.S. cosmetics case also affected highly differentiated consumer goods, but the issue was agreements for exclusive distribution through selected retailers, which raised prices indirectly.

and the EU going back to the mid 1980s in most cases. Related U.S., Canadian, and European court decisions are fully archived.

A second source of data occurs when an investigation is announced or leaked to the press or when raids on corporate offices are noticed. Then business newspapers, trade magazines, and news services begin to publish pieces on the alleged violators and their industries. Older articles are often available that describe the size, growth, and market structures of the affected markets. List and transaction prices can also be located for some industries. Among the more useful trade magazines and newsletters are *Chemical Market Reporter*, *Oil and Gas Journal*, and similar publications available on major business-and-law search engines (*Factiva*, *LexisNexis*).

Third, a small number of academic and government researchers have been compiling similar data sets. Among the most useful are working papers by Levenstein and Suslow (2002) and Levinstein, Suslow, and Oswald (2003). Some useful Government/NPO publications are OECD (2002) and Development Prospects Group (2003). And of course I have built upon data collected in my previous publications (Connor 2000, 2001, 2002), as well as publicly available information contained in unpublished consultancy reports involving cartels cited therein.

In common with nearly all other empirical studies on cartels, this paper considers only *known* cartels[23]. Specifically, the data set comprises only private cartels whose participants were aware of the illegality of their actions in at least some of the jurisdictions in which the cartel operated. These cartels were clandestine, and members typically attempted to cover up or destroy evidence of their meetings and communications (Spratling 1999)[24]. Suggestions in the cartel literature are that only about 10% to 30% of all such conspiracies are discovered and punished[25]. Undiscovered cartels are probably more durable and may differ in some other economic characteristics, but it is also possible that discovery is tied only to managerial personality characteristics (e.g., the tendency to become a whistle-blower) that are distributed disproportionately to discovered cartels. If the latter is true, then discovered cartels may be representative of the majority of cartels that are hidden.

Numbers, Size, and Industry

Descriptive statistics for the international cartels analyzed in this paper are shown in Table 2 and Appendix Table 1. There are a total of 167 cases. Most of these cartels have been fully prosecuted or have had several participants prosecuted or indicted; the greatest amount of information is available for these cases. However, 39 cases are cartels under investigation prior to indictments, guilty pleas, or the impositions of fines. That is, alleged cartel members have been subject to investigative raids or have been served subpoenas in the United States. The chances of prosecution are judged to be high.

Slightly more than one-fourth of the cartels made products sold to the food, feed, or agricultural industries. Of these, more than 80% are organic chemical intermediates. The food-

[23] There are studies of legal cartels that are presumably free of sample selection bias. (Dick 1996, Symeonidis 2002).
[24] Some of the shipping conferences met openly, but hid the extent of their price coordination.
[25] Some cartels are investigated but not indicted because the evidence of guilt is insufficient, other cases have higher priorities, or the statute of limitations intervenes. Presumably, cartelists could reveal their successful, undiscovered conspiracies five years after they terminated without legal liability, but they never do.

and-feed ingredient cartels typically had four corporate members and affected $2.6 billion of commerce during their lifespan. Three-fourths of the cartels in the data set sold nonfood products or services; these tended to be larger in terms of average membership and affected sales. However, the differences between the food and nonfood cartels nearly vanish when the *median* is the basis of comparison. The composition and sales size of the nonfood cartels is highly skewed toward a few cases with huge sales or large memberships. Thus, the median is a better measure of typicality, and this measure shows that the nonfood cartels are only slightly larger than the food-product cartels.

Cartel size varies according to geographic scope. The EU-wide cartels have the largest memberships and affected sales of any type; this reflects the importance of cartels reinforced by EU trade associations, the targeting of shipping conferences, and the durability of EU-based cartels. Despite their greater geographic spread, the median sales size of global cartels is considerably smaller than the EU-wide price-fixing schemes. Naturally, cartels confined to single nations tend to be the smallest type, with those operating only in North America the smallest of all. North American cartels affected sales that were on average less than one-tenth the sales of EU-wide cartels.

Further details on the industries occupied by international cartels are shown in Appendix Table 8. More than 90% of affected sales occurred in the manufacturing sector, and more than 95% of those manufacturers are industrial inputs: intermediate materials, components, or capital goods. By far the largest group of cartelized manufacturers is chemicals, which accounts for virtually half of affected sales in the sector. Another one-fourth of the manufacturing cartels made glass, cement, and graphite products, and most of the rest were food, paper, and metal products. Less than 5% of the sales of the cartels were consumer products (beef, sugar, beer, plastic dinnerware, cigarettes, and certain paper products). Outside the manufacturing sector, cartel sales consisted mainly of wholesale-retail distribution (5% of the total), transportation (1.5%), communication (1.3%) , other services (0.5%), and construction (0.4%). Industries with no cartels include agriculture, mining, textiles, wood, furniture, rubber, transportation equipment, and power and water systems.

During the periods of operation, these international cartels had global or regional sales of at least $436 billion (Appendix Table 7). This total is based on a sub-sample of 114 cartels for which global sales are known or have been estimated with a fair degree of precision. As the dates and regions for cartels currently under investigation become known, this total may well exceed $600 billion.[26] One case alone, the EU's *Cement* case, accounted for an estimated $32 billion in sales because virtually every large cement maker in the EU was part of the cartel for 11 years. Including this anomalous case, the food-and-feed ingredients cartels account for 23% of total affected sales.

[26] Examples of large industries in this category are carbon black, carbon fiber, tar products, plastic modifiers, and iron oxide.

Table 2. Description of Data Set: International Cartels

Cartel Characteristic	Number	Companies per cartel [b]		Total Sales Affected per Cartel	
		Mean	Median	Mean	Median
				$million	
Products:					
Food-and-feed ingredients	44	4.1	4	2,596	1,080
Other products	123	9.5	5	4,447	1,170
Total	167	8.2	5	3,830	1,200
Geographic areas affected:					
Global	51	5.3	5	5,366	1,863
EU-wide	33	12.5	6	5,307	3,390
NAFTA	32	8.4	4	1,808	281
Single European	44	8.8	5	2,063	550
Other Nations	6	5.3	5	756	525

Source: Appendix Table 7

In terms of geographic impact, only 10% of the sales of all international cartels confined their operations to the NAFTA region; another 35% of affected sales occurred within the EU (i.e., the European Economic Area). About half of the sales of markets affected by cartels involved what I have termed *global* cartels. On average, these global cartels derived about one-quarter of their sales from North America, one-quarter from Europe, and one-third from Asia.

The large number of cartels in the data set permits an examination of temporal patterns, using the date of discovery to categorize the cases. In many cases the first date at which a cartel becomes publicly known or suspected is also the date that the first guilty pleas is received or fines are announced. In other cases, the date of first notice predates the first prosecution by several months or a few years.

Rates of Discovery

One temporal pattern of interest is the rate of discovery, displayed over time, product type, or geographic type of cartel. So long as the probability of discovery does not vary over time, discovery should track the number of cartels operating fairly closely; with average lags of 6 years or so, discovery will also be correlated with rates of formation.

These rates are shown in Table 3 for three time periods: January 1990 to December 1995 (six years), January 1996 to December 1999 (four years), and January 2000 to June 2003 (3.5 years). A break between 1995 and 1996 was chosen to reflect the more aggressive prosecution of international cartels that was signaled by the DOJ's lysine-cartel case; the 1996-2003 period was dived approximately in half. The first time period includes a small number of cases with discovery dates prior to 1990 that were prosecuted during 1990-1995.

Table 3. Temporal Patterns: Rates of Cartel Discovery

Type of Cartels	Dates of Discovery [a]		
	1990-1995	1996-1999	2000-2003
	Number per year		
Food-and-agricultural:	0.8	6.0	4.0
U.S. & Canada	0.5	1.0	0.3
EU national	0	0	1.1
EU wide	0.2	0.8	1.1
Global scope	0.2	4.3	1.4
Other products:	2.7	7.5	18.5
U.S. & Canada	1.0	2.0	3.1
EU national	0	3.8	6.9[b]
EU wide	1.3	1.0	3.4
Global scope	0.3	0.8	6.3
All products:	3.5	13.5	22.6
U.S. & Canada	1.5	3.0	3.4
EU national	0	3.8	6.2[c]
EU wide	1.5	1.8	4.6
Global scope	0.5	5.0	7.7

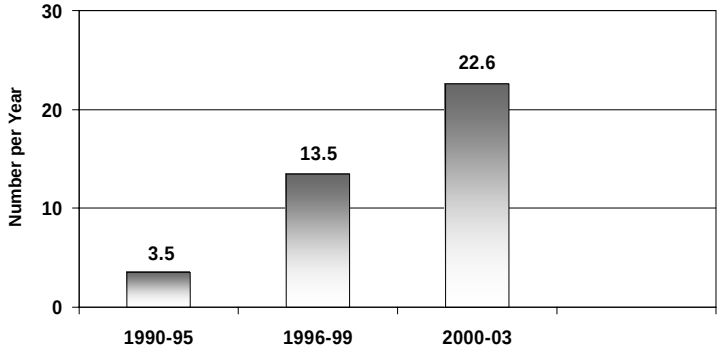
a) Slightly exaggerated by a few pre-1990 cases
b) 8.6 including 7 non-EU nations
c) 8.0 including non-EU
Source: Tables A.1 to A.12

Perhaps the most striking statistic is the number of cartels discovered per year: the rate of discovery is seven times higher in 2000-2003 than it was in 1990-1995 (Figure 1). However, the rate of increase was faster between 1990-1995 and 1996-1999 than it was between the two most recent periods, which confirms that the lysine-cartel discovery in June 1995 (convicted August-December 1996) was a watershed event. Either cartel formations increased after the early 1980s, or prosecution became more efficient.

Another pattern that leaps out from the table is the more rapid increase in the rates of discoveries among the non-food cartels. These cartels are being discovered at the rate of 13 per year since 1999, compared to 2.7 annually prior to 1996. Indeed, the rate of cartel discoveries among food-and- agricultural cartels has apparently peaked in the late 1990s. Since 1995, the proportion of global-scope cartels has remained above one-third, while only two were discovered prior to June 1995.[27]

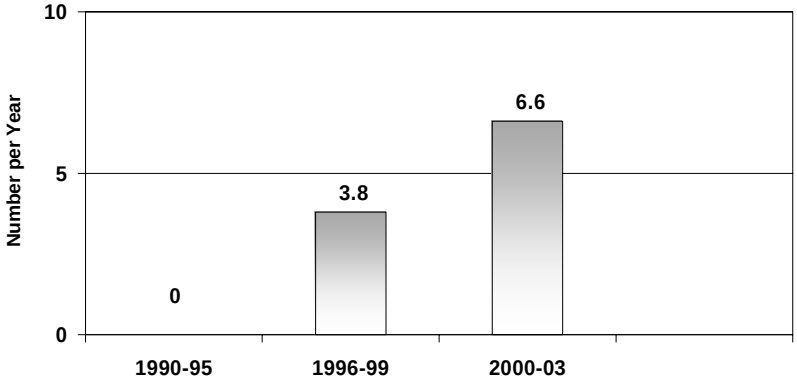
[27] The *Industrial Diamonds* case prosecuted by the DOJ in 1995 was allegedly global, but there were no guilty pleas, and the government lost at trial, so it is not in the data set.

Figure 1: Rates of Discovery: All International Cartels



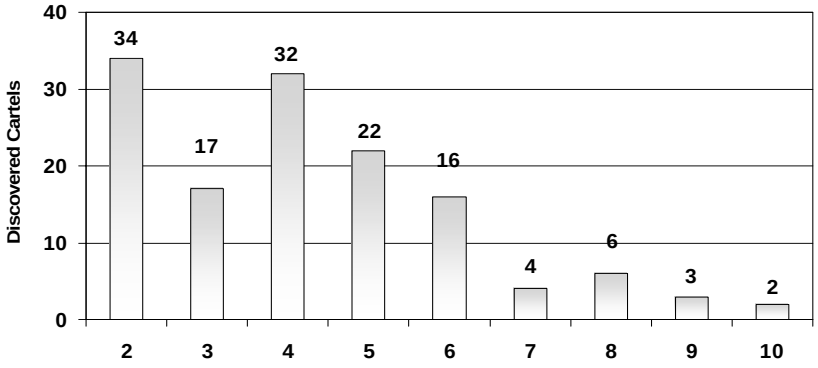
Source: Table 3

Figure 2: Rates of Discovery by European National Antitrust Authorities



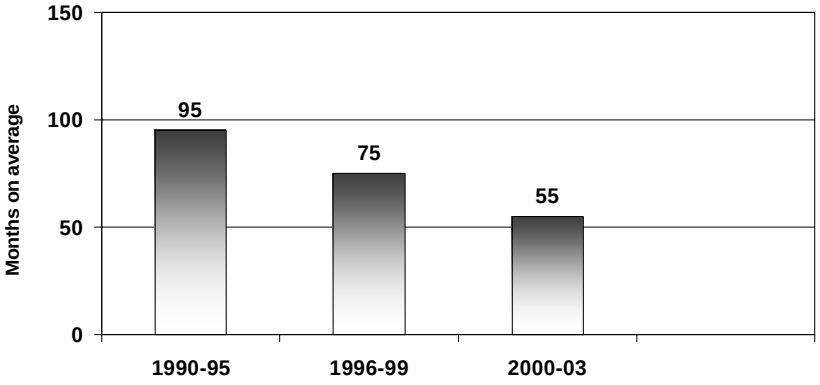
Source: Table 3

Figure 3: Number of Cartels Discovered:
by Number of Companies



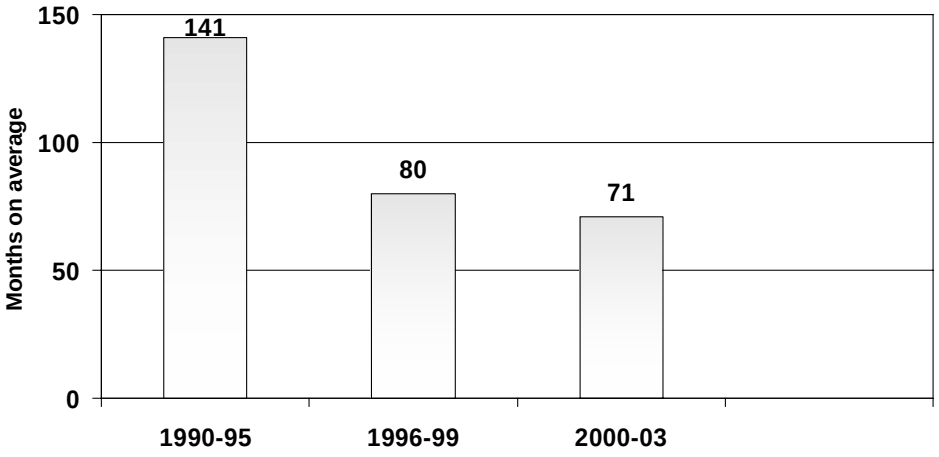
Source: Table A.1 to A.12.

Mean Durability of All International Cartels



Source: Table 4

Figure 5: Durability of Global-Scope International Cartels



Source: Table 4

Cartel Effectiveness

In this section, four measures of effectiveness are developed for international cartels: number of participants, durability, and average value of commerce affected, and the overcharge imposed on direct buyers. Each of these indexes has limitations, but each of them is directly related to the economic harm generated by the cartels.

Numbers of Participants

National variations in technology and the historical evolution of industries, including the toughness of competition and government industrial policies, lead to variations in the composition of industrial market structures. Thus, any particular national or supranational economy is has an array of industries with small, medium and large numbers of producers.

Cartel formation is more likely to occur, *ceteris paribus*, in an industry with small numbers of suppliers. Collusive behavior, both tacit and overt, is only possible when the number of rivals is small enough to make monitoring of each others' strategic moves even feasible; even smaller numbers of actual and potential rivals in a market may give rise to a structured environment that makes the formation of conjectures about rivals potentially economically profitable. When mutual dependence among market rivals becomes recognized, oligopolistic strategies are likely to emerge, of which cartel formation is one such option. In addition to simple numbers of sellers, other factors may influence the decision to form cartels. The presence of a trade association and the expectation of weak antitrust enforcement probably facilitate overt agreements by larger numbers of suppliers than in regimes with strict antitrust rules that limit the use of trade associations for conspiratorial purposes. Put another way, jurisdictions that foster

cartels with relative large numbers of participants are likely to have overall greater degrees of cartelization.

Data on the number of corporate participants are available for 163 of the 167 cartels (Appendix Table 7). The mean number of members per cartel is 8.2. The mean number is significantly lower for global cartels (5.3 companies) and significantly higher for the EU-wide (12.5) cartels. Compared with previous studies of prosecuted U.S. horizontal conspiracies, the mean is less than half the mean number for domestic cartels convicted between 1890 and 1972, but about the same for those convicted from 1963 to 1972 (Levenstein and Suslow 2002: Table 1). It is notable that among domestic cartels, the mean number of participants declined over time, a pattern that may indicate greater effectiveness of anticartel enforcement and the spread of a business culture that discourages price-fixing behavior[28].

The number of cartelists is positively skewed for the international cartels sampled here and for three samples of domestic price-fixing conspiracies (*ibid*.). Thus, the median number of companies per cartel is lower than the mean number. The median for the sampled international cartels is five; in the case of domestic U.S. cartels, the median varies from six to ten.

Figure 3 summarizes the number of companies per cartel for the 136 cases with ten or fewer members. With two exceptions, cartels with three or seven corporate members, the frequency of cartels declines monotonically with the number of corporate participants.[29] The modal number of participants is two, with a foursome not far behind. The dip in the frequency of triopolies is puzzling and has not been noted previously in the economics literature.

A striking feature revealed by Figure 3 is the precipitous drop-off in the number of cartels with more than six participants. This finding is in accord with a couple of game-theoretic models of cartels (Selten 1973, Farris *et al*., Phlips 1995). Of the cartels depicted in Figure 3, 89% had six or fewer corporate participants.

What is not shown in Figure 3 is the fact that approximately 13% of all discovered international cartels were reported to have more than ten participants. Indeed, in ten cases (13%) cartels had 16 or more members. There appear to be four explanations for the existence of cartels with large numbers of participants. First, the great majority of such cartels were prosecuted by the EU or its member states (see Table 2). In these jurisdictions trade associations are more likely to have official or quasi-official status.[30] The EC has a policy of encouraging and supporting the development of EU federations of national trade associations, many of which have affiliated units of corporate trade associations that have been used, unwittingly or otherwise, to facilitate private cartels.[31] The role played by such trade associations was

[28] One study showed a peak in 1920-1934 , which corresponds to a period of relatively lax antitrust enforcement.
[29] For a small number of cases still under investigation, prosecutions are pending, which makes it likely that additional participants may become public in the future. When these figures are finalized, the rate of decline will be lower.
[30] See, e.g., FEFANA. These comments may also apply to Japan and some other Asian countries.
[31] A related form of official assistance is in the provision of excessively detailed, publicly available price data (Albaek *et al.* 1997). Analogously, the DOJ has mentioned the role played by the trade magazine *Chemical Market Reporter* in printing prices that were the basis of price fixing methods. A survey of 16 deep historical studies of

documented in the case of the lysine and citric acid cartels by Connor (2000: Chapter 5 and 8). Other cartels helped by trade associations appear to include cement (the EU, German, and Italian cartels), Dutch prawns, asphalt in Sweden and Finland, diesel fuel distribution in Lombardy, Dutch construction, and German industrial property insurance. In many of these cases, the trade associations were cited as violators and given fines. (In one U.S. FTC case, the only defendant was an international trade association for interpreters, the AIIC). In the United States the special status of farmers' cooperatives also makes possible cartels with large numbers (Medhaven *et al*. 1994).

Second, the EC has prosecuted at least six shipping conferences, four with large numbers of members (each had from 13 to 34 members). Liner conferences have bloc exemptions for many of their activities under EU competition rules, but are not permitted to fix prices for their members. In some cases these liner conferences have persisted in fixing shipping rates even after being denied exemptions for that activity. This appears to be a business institution that like trade associations can provide a cover for illegal behavior while operating openly for legitimate business purposes.

Third, some cartels with large numbers of participants have combined both horizontal and vertical price-fixing activities. In these cases, both manufacturers and distributors have been identified as members of a broad cartel in which the manufacturers horizontally fixed prices or terms of trade, and then manufacturers offered exclusivity contracts with retailers in return for no-sale policies in retail pricing. The U.S. cosmetics and UK toys and games cases fit this pattern.

Fourth, perhaps the most common reason for unexpectedly large numbers of participants is a failure to define the market boundaries properly for prosecution purposes. In particular, antitrust agencies find it convenient at times to investigate and prosecute multiple geographic or product cartels as though they were one conspiracy. The global vitamins case is frequently cited as a single violation, whereas the U.S. and EC cases clearly brought single actions against what were 15 cartels; although somewhat related by overlapping membership, each of these cartels had distinct product lines and time spans, each with from two to six participants that totaled about 20 companies. More commonly, cartels have sold products that are bulky and, therefore, are sold in local and sub-national geographic areas. Sometimes the cartels consist of one or a few firms with multi-market distribution that collude with a number of smaller firms. In such cases, it is appropriate to view "the cartel" as a series of overlapping circles or market areas; each area is a cartel populated by a unique combination of participants, some large ringleaders and some smaller followers, where the large leaders appear in two or more of the local cartels. This concept applies to the EU cement (42 companies), German ready-mix cement (69 companies), and district heating pipe (10 companies) cartels. Large cement companies like Lafarge (France) or Hocim (Switzerland) operated in many distinct geographic cement markets, but many of the smallest violators operated in only on or two of them. In the heating pipes case, Asea Brown Boveri sold pipes in both Denmark and Germany, but several of the makers confined their sales to one country alone. Other cartels that were probably amalgamations of multiple localized

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international cartels finds that half of them had more than 12 members during at least some portions of their active periods; large numbers in every case can be traced to trade associations (Levenstein and Suslow 2002:16).

cartels are: bitumen, asphalt, construction, cartonboard, compressed gases, steel beams, and Euro-zone banks. In these cases, the large numbers of participants is exaggerated.

Durability

Durability or longevity is the total life span of an effective overt agreement on prices, from formation to abandonment (usually because of discovery or failure to prevent entry). If a cartel ceases to affect prices yet maintains a formal management structure, this period should not be counted as part of its duration. *Ceteris paribus*, the durability of cartels is doubtless an unambiguous indicator of the cohesiveness of a collusive group[32]. However, cartel discipline is likely to be positively related in turn to a number of factors, including the opportunity for generating relatively large monopoly profits and to the persistence of entry barriers during the collusive period (Marquez 1994, Dick 1996). Cartelists may be able to control the probability of defection and may be able to adopt strategies to raise or maintain barriers to entry, but potential profitability and some types of entry barriers arise largely out of the structural environment of the cartel's market. A number of collusive models (e.g., Rotemberg and Soloner 1986) suggest that demand shocks will require price agreements to be renegotiated, and some of these renegotiations may be unsuccessful. Besides demand shifts, other structural changes will require periodic changes in price or quantity agreements (Slade 1989). Alexander (2003) emphasizes unstable currency exchange rates as a source of international-cartel breakdown.

Levenstein and Suslow survey five empirical studies of cartel duration, three of them samples of international cartels (Table 6). High cartel control, low buyer concentration, low demand variability, low growth in demand, high profitability, and a history of cooperation positively affect longevity. Dick (1996) also finds that the formation of a common sales agency and the age of the cartel aid cartel durability. Experience, history, and the development of more complex management rules and structures go hand in hand to contribute to duration. Suslow (1991) concludes that cartels holding patents and those focused on narrow product lines are more durable. Unexpectedly, industry concentration and the number of participants have no significant effect on longevity.

Trends in discovered international-cartel durability are displayed in Table 4. On average these cartels spanned almost six years (i.e., about 69 months). Over the entire 1990-2003 period of observation, there is very little variability in durability that can be ascribed to the cartels' industry groups. However, geographic scope of cartel operation appears to be systematically related to durability. The NAFTA area cartels were of average durability, but the cartels prosecuted by national European authorities operated for 30% shorter periods than the average (4 years rather than 6). The multinational cartels of Europe and the global cartels lasted 25% longer than average (more than seven years).

The international cartels in this paper's data set are more durable than most international cartels active in the years 1819-1984 (Levenstein and Suslow 2002: Table 2). Three studies of older cartels find that mean durations ranged from 3.7 to 4.6 years; one finds durability averaged

[32] Durability should not be equated with cartel stability, which is the infrequency with which collusion breaks down (or "reverts to Cournot" in the language of game theory). Durable cartels may have few or many episodes of price wars.

7.3 years[33]. The range in these studies was from a few months to 29 years. However, a survey of 16 deep historical case studies of international cartels that began operating in the 19th or early 20th centuries determined the mean duration to be 17.2 years (median of 8 years) (*ibid*. Table 9). The South African gem diamonds cartel lasted 120 years, in two separate episodes of 20 and 100 years (Spar 1994). One cartel (potash) was active for 75 years, but formed and reformed eight times. These historical case studies tend to be selected because of there instability.

Table 4. Average Durability of International Cartels, by Type, Over Time.

Types of Cartels	Date of Discovery		
	1990-1995	1996-1999	2000-2003
	Months		
Product Groups:			
Food and agricultural	38^{5}	76^{25}	56^{8}
Other manufacturers	117^{10}	59^{15}	61^{32}
Services	10^{56}	94^{10}	44^{17}
All industries	95^{21}	75^{50}	55^{57}
Geographic scope:			
U.S. and Canada	66^{9}	95^{11}	45^{10}
Nations in Europe	$--^{0}$	51^{8}	47^{22}
EU wide	12^{68}	63^{5}	49^{4}
Global	14^{14}	80^{20}	71^{21}

-- = No observations
Note: Superscript indicate sample size
Source: Tables A.1- A.12.

One notable trend is a decline in cartel durability (Figure 4). The average durability of international cartels discovered in 2000-2003 was more than 40% shorter than those discovered in the early 1990s. The decline in mean durability has affected every industry category and geographic location. The mean durability of *global* cartels is generally higher than those of more limited geographic scope, but these too have fallen over time (Figure 5).

The most rapid increase in rates of discovery occurred among the national antitrust agencies of Europe and other countries outside North America and the EU. Rates of cartel discovery more than doubled in North America and the EU from the early 1990s to the early 2000s (Table 3). However, from *no* activity prior to 1996, the European national agencies began investigations of international cartels at a rate of nearly four cases per year in the late 1990s. The Netherlands authority NMa, newly empowered with greater investigative powers, brought a case against seven distributors of compressed industrial gasses in 1997, all of which were non-Dutch firms. Spain began investigation price fixing by the three leading gasoline retailers in 1999, a move soon imitated in Italy; in both cases the investigations followed their governments'

[33] If a cartel disbanded and later reformed, each episode is counted as a separate observation.

withdrawal from administrative control of petroleum-product prices. In 2000-2002, similar cases against retail gasoline companies were launched in Sweden, France, the Netherlands, Chile, and the Czech Republic. In the late 1990s Italy, with the newest antitrust law in the EU, brought nine cases against international cartels in a wide variety of industries: recorded music, cell phones, gas water heaters, glass containers, auditing services, and drugs. During 2000-2003, Italy increased the pace of discovery with seven new cases launched or concluded, a record only matched by NMa. The other European antitrust authorities with international anti-cartel activity during 1997-2003 were Germany (three cases), France (three), the UK (three), Norway (two), Sweden (two), and one each in Finland, Hungary, and the Czech Republic. Korea, Japan, Mexico, Australia, and Chile also brought international cartel cases in recent years.

It should be mentioned that in this analysis of average durability's of cartels, the mean has been employed. However, the range of cartel durability's is quite large, and the distribution is skewed by a few very large observations. The most durable cartel in the data set is the soda ash duopoly, which lasted from 1945 to early 1989 (530 months) and was fined by the EC in December 1990. The second most durable was the AIIC case, and association that fixed prices and contract terms for its members from 1956 to 1996, the year in which it signed a consent decree with the U.S. FTC. Most of the liner conference cases also displayed exceptional longevity. The briefest cartel in the data set is a Dutch action taken against three petroleum stations for three days of price fixing, but this degree of brevity is quite exceptional. As a result of a much larger proportion of very long lived cartels than brief ones, the sample is skewed and the median durability's are lower than the means. A re-examination of durability using medians demonstrates that the trends are not much affected by this conversion.

This general trend toward discovery of cartels with increasingly shorter life spans is a phenomenon that deserves an explanation. One possibility is that highly experienced cartelists have become more adept at keeping their conspiracies clandestine, while at the same time cartels formed in more recent periods have not developed such skills. For example, the more recently discovered cartels appear to have a higher proportion of Asian companies than earlier cartels. Perhaps Asian managers, whose business experience is derived mainly from countries with lax antitrust enforcement, are not as concerned about covering up their cartel participation. Another possibility is that the reservoir of discoverable cartels in the early 1990s simply contained a higher proportion of long-lived cartels than those discovered in the early 2000s. *Ceteris paribus* one would think that long-lasting cartels are easier to detect by antitrust authorities than newly formed cartels, if only because there are more potential corporate and individual whistle-blowers available for durable agreements because of the natural turnover in participants. Moreover, as will be discussed below, it is doubtless true that the leniency programs adopted by many of the world's leading antitrust agencies have been increasingly effective in leading to cartel discoveries. On the whole, this second, more sanguine explanation of declining cartel life spans seems the more likely alternative.

The analysis of changes in cartel durability just presented used discovery dates, which is an *ex post* or retrospective approach. From the viewpoint of antitrust enforcement, a more relevant analysis is one that focuses on the *ex ante* decision of cartel formation. As discussed in more detail below, the overarching objective of anticartel laws is to deter companies from collusion in the first place. Therefore, in Table 4A durability is examined prospectively by

categorizing the cartels according to the year in which they were first formed; starting dates are available for three-fourths of the sample.

Looking first at the cartels in all industries, it is apparent that mean cartel durability has declined considerably over time. Cartels launched before 1981 were about four times as durable as the discovered cartels that began in the early 1990s. However, the reader must be cautioned that some of the decline in mean longevity is a statistical artifact that results from the 1990 cutoff date used to construct the data set. The fact that only those cartels discovered since the beginning of 1990 are included implies that even if the average durability of cartels was equal for all starting periods, the mean durability would appear to decline because of the sampling date. Moreover, the data in the later periods are affected by the fact that mid-2003 is the cutoff, placing an absolute ceiling of 42 months on cartels started after January 2000. Observations from 1996 are biased strongly downward because of this ceiling. Nevertheless, statistical sampling artifacts probably do not explain most of the decline in durability of international cartels from those formed decades ago to those formed in the early 1990s.

The mean longevity of cartels in the services industries is significantly higher in all formation periods (up to 1995) than cartels in all other industries. On average, service-industry cartels formed before 1996 last 20% longer than the average cartel and about one-third longer than manufacturing-sector cartels (Table 4A). In terms of geographic spread, cartels operating in North America are about 15% shorter in duration than the average cartels, whereas those operating in only one European country typically endure about 20% longer and the global-scope cartels 25% longer. These differences persist whether one examines mean or median durability (Table 4B).

Table 4A. Average Durability of International Cartels, by Type, by Starting Date

Type	Starting Date						
	Before 1981	1981-1986	1987-1989	1990-1992 [a]	1993-1995	1996-1999	2000-2003
	Mean months						
Product groups:							
Food and agricultural	147[2]	121[2]	92[4]	56[20]	69[5]	29[2]	30[3]
Other manufacturers	244[3]	102[5]	65[4]	74[12]	62[20]	43[12]	13[2]
Services	276[3]	147[2]	100[1]	58[6]	69[6]	32[8]	15[5]
All industries	232[8]	116[9]	81[9]	62[38]	64[31]	38[22]	19[10]
Geographic scope:							
U.S. and Canada	200[3]	108[2]	74[7]	44[9]	54[3]	32[6]	39[1]
Nations in Europe	--	113[2]	--	84[2]	64[16]	32[8]	18[7]
EU-wide	288[2]	80[3]	--	53[6]	72[2]	54[3]	--
Global	226[3]	183[2]	104[2]	72[21]	66[10]	47[5]	13[2]

-- = No observations
Note: Superscript indicate sample size
Source: Tables A.1- A.12.
a) The bulk of the vitamin cartels began in this period, 12 of the 15.

Table 4B. Average Durability of International Cartels, by Type and Starting Date

Type	Starting Date						
	Before 1981	1981-1986	1987-1989	1990-1992 [a]	1993-1995	1996-1999	2000-2003
	Median months						
Product groups:							
Food and agricultural	147[2]	121[2]	91[4]	44[20]	69[5]	29[2]	36[3]
Other manufacturers	156[3]	108[5]	59[4]	83[12]	49[20]	48[12]	13[2]
Services	252[3]	147[2]	100[1]	63[6]	75[6]	33[8]	14[5]
All industries	213[8]	108[9]	94[9]	53[38]	60[31]	40[22]	14[10]
Geographic scope:							
U.S. and Canada	156[3]	108[2]	88[7]	53[9]	33[3]	16[6]	39[1]
Nations in Europe	--	113[2]	--	84[2]	72[16]	38[8]	14[7]
EU-wide	288[2]	84[3]	--	48[6]	72[2]	61[3]	--
Global	216[3]	183[2]	104[2]	76[21]	60[10]	48[5]	13[2]

-- = No observations
Note: Superscript indicate sample size
Source: Tables A.1- A.12.
a) The bulk of the vitamin cartels began in this period, 12 of the 15.

Affected Sales

Affected sales are simply the total revenues of the members of a cartel during the life span of the cartel. Data are available on affected sales for about 70% of the sample. If reports of the antitrust authorities did not reveal the sales of convicted cartels, then sales were estimated for the relevant time span and geographic area for the entire market by using a variety of government, trade association, or industry publications. The proportion of known sales is somewhat lower (about 60%) for cartels discovered since 1999 than for cartels discovered prior to 2000 because this latest time period contains most of the un-prosecuted cases still under investigation; without information about the span of the conspiracy, it is usually impossible to determine the affected sales. All sales are converted to current U.S. dollars[34].

The mean sales sizes of international cartels discovered since 1990 are shown in Table 5. Total affected sales for all industries, geographic areas of operation, and time periods are more than $480 billion, or a mean value of $4.4 billion per cartel.[35] A few interesting patterns may be observed. First, the mean size of cartels located in the manufacturing industries tends to be larger than cartels involved in transportation, distribution, construction, finance, and other service industries. The mean size of the food-and-agricultural cartels (most of them organic chemical

[34] Affected sales in current dollars are a lower absolute number than sales corrected for inflation would be. However, because most cartels were formed after 1982 when global inflation was modest, the degree of understatement is not serious and tends to be compensated by the minority of estimates based on industry-wide sales (rather than the normally slightly smaller cartel sales).

[35] Global inflation has been a modest 2 to 3 percent per year since the early 1980s, but some of the cartels had sales as far back as the 1940s. Although conversion to 2003 dollars would be desirable, it is a formidable task. In present dollars, total sales of this sub-sample is probably $700 to $800 billion.

ingredients), together with other organic chemicals, increased from the early 1990s to the early 2000s. Second, the mean size of other manufacturing cartels, although relatively large, seems to have declined; however, this apparent decline is due to a small number of very large EU cartels prosecuted in the early 1990s. The two cartels that may distort the trend are the huge ($32 billion) and durable (139 months) cement cartel and the $13-billion cartonboard cartel. Two other exceptionally large cartels ($25 and $29 billion) are the U.S. glass containers cartel and the flat glass cartel, which were found guilty at civil trials in 1990 and by settlement in 1997. Third, the mean size of global cartels has risen substantially over time; the late-1995 lysine case is the only cartel in the early period, but this trend is clear from the late 1990s to the early 2000s as well.

The extreme skewness in sales figures in most of the categories shown in Table 5 suggests that the *median* sales size is more informative about the average than the mean (see Table 5A). Examining trends in medians reveals that the increase in the food, agricultural, and organic chemical cartels is pronounced in the early 2000s; this is a bit surprising because the 1996-1999 period includes 14 vitamins cartels, many of which were quite large. The median sizes of all four industry categories dipped in 1996-1999, but only the services cartels failed to bounce back in the early 2000s.

Trends in geographic categories largely reflect the enforcement priorities of the world's chief antitrust authorities. While the mean size of the NAFTA cartels has decreased (Table 5), the *median* size of these mostly U.S. – prosecuted cartels has increased (Table 5A). The reason that the means show a decline is that the two civil cases mentioned above (glass containers, flat glass) were huge (*78 times* larger than the remaining NAFTA cases of the 1990s). The median, therefore, is more representative of the more typical criminal cases brought by the U.S. DOJ., and these have increased sharply in median sized from the 1990s, to the early 2000s.[36]

The two European categories tell an interesting tale. Beginning in the very late 1990s, a new division of responsibility emerged between the EC and the competition-law authorities of the Member States with respect to cartel enforcement. The EC and European Court encouraged the national European authorities to prosecute cartels that have limited geographic impacts, usually one country. Thus, one observed relatively small but significant cartels being investigated and prosecuted by European national authorities after the mid-1990s. Simultaneously, the size of EU-wide cartels (solely prosecuted by the EC) has sharply declined, especially when measured by the median, while the size of global cartels (prosecuted by the U.S. or EU or both) has markedly increased (Figure 6). These patterns are consistent with a policy shift that allows the EC to focus on larger, mostly global-scope cartels, while the Member States focus on smaller more localized conspiracies. This is, of course, the division of responsibility long followed in the United States.

[36] The early 2000, includes only a year or so fully influenced by the new Bush administration, so it remains to be seen whether one will observe a return to Baxter: style enforcement (i.e,. a focus on many very small bid-rigging cases).

Table 5. Mean Affected Sales of International Cartels, by Product and Geographic Type

Type	Date of Discovery		
	1990-1995	1996-1999	2000-2003
	Million dollars per cartel		
Product groups:			
Food and agricultural	1,566[3]	2,355[27]	3,839[8]
Organic chemicals[a]	160[1]	5[1]	8,216[13]
Other manufacturers	10,316[9]	4,162[17]	4,618[18]
Services	1,802[2]	4,343[5]	731[6]
All industries	6,754[15]	3,121[50]	5,001[45]
Geographic scope:			
National EU	--[0]	2,508[12]	2,438[16]
NAFTA nations	4,668[7]	2,937[11]	1,947[8]
EU-wide	9,528[7]	4,398[7]	2,416[5]
Global	1,932[1]	3,117[20]	9,764[16]
All areas	6,754[15]	3,121[50]	5,001[45]

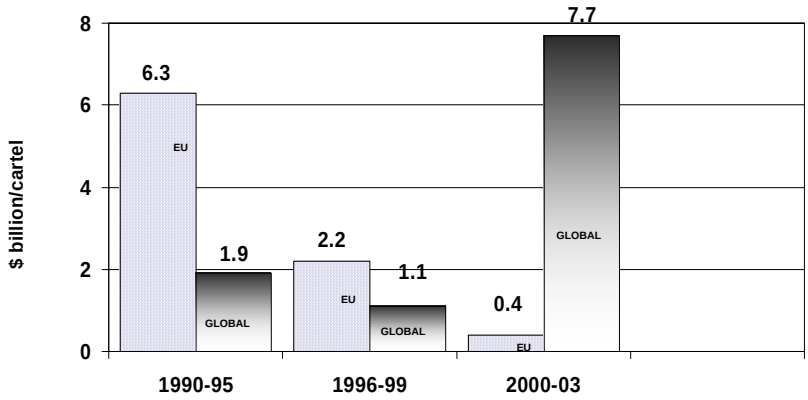
a) Organic chemical intermediates not purchased by the food, feeds, or agricultural industries.
Note: superscripts indicate numbers of observations
Source: Table A.1 to A.12.

Table 5A. Median Affected Sales of International Cartels, by Product and Geographic Type

Type	Date of Discovery		
	1990-1995	1996-1999	2000-2003
	Million dollars per cartel		
Product groups:			
Food and agricultural	1,932	600	1,650
Organic chemicals [a]	160	5	7,750
Other manufacturers	7,000	950	1,663
Services	1,800	1,000	361
All industries	2,745	715	1,100
Geographic scope:			
National EU	--	509	525
NAFTA nations	200	500	1,400
EU-wide	6,250	2,167	375
Global	1,932	1,140	7,650
All areas	2,745	715	1,100

a) Organic chemical intermediates not purchased by the food, feed, and agricultural industries.
Source: Table A.1 to A.12.

Figure 6: Median Size of Affected Sales



Overcharges

The third measure of cartel effectiveness is the average percentage overcharge during the affected period. In general, illegal cartels are unable to achieve the full monopoly price because of disagreements among members, fear of entry, the existence of substitutes, or concerns about discovery. An ideal measure of cartel effectiveness would be the average cartel price relative to the monopoly price. Overcharge data are difficult to find for cartels, but calculating a monopoly price is virtually impossible. A sample of 70 observations has been developed for this paper[37].

The mean average overcharge is 28% of affected sales (Table 6). The overcharges are surprisingly invariant to the industry of the cartel. For the whole period 1990-2003, most industries displayed averages of between 25% and 35%; moreover, geographic scope made little difference as to the degree of monopoly power achieved. Of course these are averages; at the individual cartel level, the overcharges varied from 4% to 100%.

Levenstein and Suslow (2002) surveyed studies of the price effects of international cartels. From their own sample of 35 cartels prosecuted since about 1990, the mean for 17 overcharge observations is 39.4% (Table 15)[38]; the median is about 25% (p.20). Eckbo (1976) judged that the Lerner index for 37% of his 51 international cartels that operated in 18 industries from 1819 to 1964 exceeded 0.67; depending on the levels of competitive profits in the industries, the mean overcharge is somewhere around 55-65%. Griffin's (1989) sample of 54 cartels active in 22 industries 1888-1984 had a mean Lerner index of 0.31, which corresponds to

[37] Readers should be aware that 12 of the 70 estimates are vitamin cartels. Several estimates were developed by the author using generally conservative assumptions (Connor 2001: 319-336), while others are extracted from documents or decisions by prosecuting parties. Thus, there may be a slight overstatement for the latter group.
[38] I took the middle of some ranges; there are 12 cartels with data; in four cartels multiple geographic overcharges are given.

an average overcharge of about 25 to 30%. In sum, the price effects found in the present study are about the same as Griffin's but lower than the other two studies.

Changes over time were also generally slight. Partly because no global cartels were discovered and prosecuted before 1995, the average overcharges rose form the early 1990s to the late 1990s. The degree of overcharge has remained particularly steady among the cartels in the organic chemicals industry (which includes most of the food-and-agricultural cartels).

Cartel studies have found it difficult to estimate the determinants of profitability (Levenstein and Suslow 2002:8). Historians are often not interested in quantifying the impacts of the cartels that they study. In their compilation of 16 monograph-length historical studies of international cartels, only five provided specific calculations of the price increases caused by the cartel, many of which were immediate or short-run price changes (ibid. Table 8). The South African cement cartel maintained prices 10% above the word price (Leach 1994); diamond prices increased almost 50% after the initial formation (Spar 1994); the potash cartel increased prices 100% above average costs in the year after initial formation (Levenstein 2000, Schroter 1993); German steel prices were 33% higher than world prices (Baker 1989, Barbezat 1989, 1990, 1994); and tea prices rose 80% in 1933 when the cartel was re-established (Gupta 1997, 2001). The mean price increase of the five cartels is 55% and the median is 50%.

Table 6. Percentage Overcharges of International Cartels, by Type.

Type of Cartel	Date of Discovery		
	1990-1995	1996-2003	1990-2003
	Percent		
Product Groups:			
Organic chemicals	26^{3}	25^{18}	25^{21}
Other industries	19^{5}	51^{5}	35^{10}
All industries	22^{8}	30^{23}	28^{31}
Geographic Scope:			
National	27^{5}	--	27^{5}
Regional	14^{3}	39^{4}	28^{7}
Global	--	28^{19}	28^{19}
All areas	22^{8}	30^{23}	28^{31}

-- = No observations
Note: Superscripts indicate sample size.

Anticartel Enforcement

General Trends

In a standard textbook on antitrust policies written in the early 1980s, the author tells the story of the international uranium cartel of 1972-1975. This cartel was comprised of 29 suppliers of uranium, 17 of them U.S. firms that were successfully sued for treble damages by the largest U.S. buyer of uranium. The fact that the U.S. DOJ never indicted the cartel

> "… demonstrates that the strict [U.S.] policy against price fixing largely exempts foreign cartels, even if they have U.S. members ... and probably affect prices in the United States." (Shepherd 1985)[39]

How different the attitude is two decades later. In the United States, the early 1990s represent a major watershed in international cartel enforcement policies and effort. From 1945 to late 1996, U.S. prosecutions of international price-fixing schemes were rare and almost inevitably unsuccessful. Since 1995, the U.S. DOJ has had a large number of legal victories against harmful, secretive global cartels. The Antitrust Division, together with its sister competition agencies in many other jurisdictions, has steadily expanded its investigatory methods, powers to negotiate guilty pleas, and harshness of penalties for noncooperative violators.

The competition directorate of the European Commission (EC) has also experienced a rising number of investigations of alleged cartel violations since the 1980s and during the 1990s. Most price-fixing cases pursued by the EC are international in the sense used in this paper, i.e., the corporate participants hail from two or more nations, and most also involved schemes that affected trade between the member states of the EU. However, the great majority of these cases have involved companies and geographic areas totally within the jurisdiction of the EC. Therefore, the EC has not had as many difficulties prosecuting international cartels as the United States and Canada.

For Europe, prosecution of cartels has involved an intensification of effort and greater harshness of sanctions after 1995. The EC's first decision against a secret cartel was adopted in 1969 (Monti 2002). The total amount of cartel fines imposed from 1969 to 1995 was €500 million in 33 cases (i.e., about 1.4 cases and $23 million per year on average). Beginning in 1996, the EC offered discounts on fines for companies that cooperated in cartel investigations, and this first leniency policy accelerated the number of cartel investigations. From 1996 to 2001, 24 cartel decisions were handed down and €2800 million in fines were imposed on 160 companies (4.8 decisions and about $560 million per year). In February 2002, a second leniency program was approved; it offered quicker decisions on discounts and the possibility of full immunity; in that year alone 9 cases were decided with fines of €1038 million (approximately $980 million). Therefore, the EC's anticartel activity 1995-2001 has comprised 88% of all the fines imposed since the EU was formed.

[39] Shepherd does not mention U.S. government partly decided not to prosecute because the Canadian government was a party to the agreement (Spar 1994). The participation of foreign governments in cartels greatly complicates prosecutions.

Three changes in the nature of anticartel activity may be noted in Europe after 1995. First, the EC has become deeply involved in investigating and prosecuting *global* cartels for the first time. Of the 28 global cartels fined by the EC, all but two were sanctioned after 1995 (Appendix Table 3). Second, the EC has for the first time formally and extensively investigated international cartels with the direct cooperation of antitrust authorities outside the EU. There are at least 13 examples of such joint investigations (Table 7). U.S. – EC joint efforts are the most common, the first being the graphite electrodes cartel in 1997. In 2000, the first global cartel investigation involving four jurisdictions was launched. Third, competition directorate was reorganized to create a special unit devoted to anticartel activity; a second unit was established in 2002 (Monti 2002:1-2). Fourth, the 1996 and 2001 leniency programs (discussed in greater detail below) were highly productive. From 1996 to 2001, more than 50% of all conspiring companies received leniency for their cooperation. In early 2002, the EC was receiving two leniency applications per month (*ibid*.).

The final qualitative change in EC anticartel enforcement is the devolution of such activity exclusively from the EC to the national authorities of its member states. Similar to the federal-state concurrent enforcement in the United States, the EC has fostered the involvement of the member states in prosecuting conspiracies that operated within one nation's boundaries. At least 32 international cartels have been fined by the European national antitrust authorities, all since 1997 and 80% of them since 1999 (Appendix Table 3). Most of these cartel prosecutions have been pursued under the national antitrust laws of the member states, but in one case the Netherlands prosecuted an international cartel using Article 81 of the EU Treaty. In another interesting innovation in 2002, the Norwegian and German antitrust authorities launched a joint investigation of an alleged cartel in calcium carbide (Table 7).

The acceleration in annual rates of discovery of international cartels is quite impressive. Recall that "discovery" means the first date that a formal investigation becomes publicly known, which in some cases is also the date that sanctions are levied. In the case of global-scope cartels, only four more were discovered prior to 1996 (Figure 7). By the late 1990s, the rate of discovery of global cartels was more than six times faster than the early 1990s. After 1999, the rate had risen to eight per year – ten times faster than a decade earlier.

The rate of discovery is even more rapid among international cartels that operated in only one country.[40] In the early 1990s, only 2.2 international cartels were being discovered each year, most in Canada or the United States (Figure 8). In the early 2000s, more than 13 of this type were being uncovered each year, the vast majority in Europe by the national authorities. Eight cartels have been prosecuted by authorities outside North America and the EU (Australia, Hungary, the Czech Republic, Japan, Korea, and Chile), all since 1998.

[40] Three cases in this category operated in both Canada and the United States.

Table 7. Joint Investigations

Date [a]	Case	Authority				
		USDOJ	CCB	EC	JFTC	Other
June 1997	Graphite electrodes	√		√		
Oct. 2002	Rubber processing chemicals	√		√		
Oct. 2002	EPDM synthetic rubber	√	√			
Nov. 2002	Carbon block	√		√		
Dec. 2002	Tar pitch	√		√		
Dec. 2002	Creosote	√		√		
Dec. 2002	Naphthalene	√		√		
Feb. 2003	Parcel tankers, chemical	√		√		
Feb. 2003	PVC plastic impact modifiers	√	√	√	√	
Feb. 2003	PVC plastic heat stabilizers	√	√	√	√	
Feb. 2003	MBS	√	√	√	√	
May 2003	Copper concentrate	√	√	√		AUS
Jan. 2003	Sulfuric acid [b]	√	√			
Dec. 2002	Calcium carbide [c]					DE/NOR

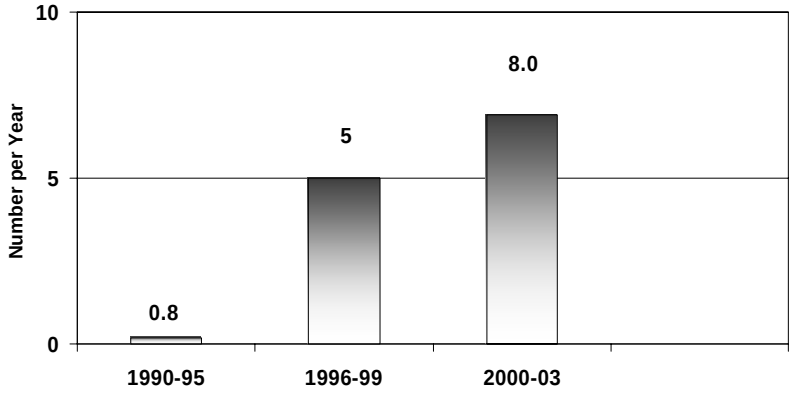
a) Date on which raids or joint investigations are first made public by the authorities themselves, by companies seeking amnesty, by targets in their financial reports, or by investigative journalism. Not all raids are made public.

b) First known example of a NAFTA-area case.

c) First known example of joint investigation by European national authorities.

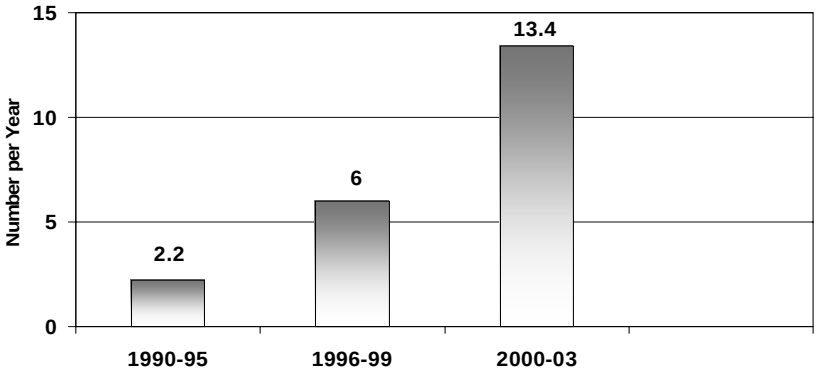
Source: Tables A.1 –A.12.

Figure 7: Rates of Discovery: Global-Scope Cartels



Source: App. Table 3

Figure 8: Rates of Discovery: Single National Market Scope



The prosecutorial success of the U.S. DOJ and the EC's DG-4 have encouraged other national agencies to focus more resources on anticartel enforcement, to adopt new laws strengthening investigatory powers or raising sanctions, and to reorganize the antitrust authorities. More vigorous enforcement is noted since the mid 1990s in Australia, South Korea, and selected East Asian countries (Round 2002). The UK has made the most sweeping changes; in 2003 price fixing was criminalized, fines were raised, and prison sentences of up to five years were made possible.

Antitrust authorities have been goaded into action by the disrespect shown by cartelists to competition laws and those who enforce them. Speech after speech by top antitrust officials betrays a visceral antipathy for global price fixers. The global conspirators are consistently described in highly emotive language as brazen, cold-blooded, contemptuous of the law, disdainful of their customers, and eager to break their own companies' rules (Hammond 2002, Spratling 1999, Monti 2001). Particularly surprising to antitrust prosecutors is the involvement of the most senior officers of colluding firms in the management of the cartel. At the same time, these global cartelists have shown a fear for the ability of U.S. authorities to detect their illegal activities by avoiding meetings on U.S. territory and by trying to hide the existence of the cartel from U.S. employees; these practices were particularly evident after the lysine-cartel investigation became public in 1995. Elaborate measures were taken to cover up the cartel's activities wherever the conspiracy took place.

Once the threat of global conspiracies came to be recognized by the newly appointed head of the Antitrust Division in 1992-1993, the agency reordered its priorities fairly quickly. Prior to 1995, less than 1 percent of the corporations accused of criminal price fixing were

foreign-based firms; after 1997, more than 50 percent were non-U.S. corporations. Fines imposed on global price fixers escalated steeply from 1996 to 1999, with new record amounts collected nearly every year. In 1999 alone, the $900-million-plus collected from international price fixers was far more than the entire 108 years of U.S. antitrust enforcement. Nearly four-fifths of the DOJ's fines for criminal price fixing were imposed on non-U.S. firms in the late 1990s. The use of personal fines and prison sentences has also escalated; since 1995, the U.S. government has sent more than 30 executives to prison for price-fixing, and a high proportion are not U.S. citizens. Perhaps more importantly, the success enjoyed by the U.S. DOJ has been increasingly mimicked abroad by the antitrust agencies of Canada, the EU, Mexico, Korea, Brazil, and Australia. In 2001, the EU collected more than €1.8 billion in price fixing fines; from 1998 to 2001, the total was €2.5 billion (Arbault 2002).

This section presents some original data on the prosecutions by the U.S., Canada, and EU of international cartels, most of them global in scope.[41] The purpose is to show the pattern of anticartel enforcement by government agencies of three jurisdictions that have the most active programs to deter price fixing. These data are necessary to develop a fuller understanding of the potential for effective cartel deterrence in the long run.

The U.S. Department of Justice

The U.S. Sherman Act became law in July 1890. While the U.S. Congress has implemented many clarifying amendments over the years, the section of the Sherman Act that prohibits all agreements, contracts, or conspiracies in restraint of trade has remained virtually untouched in its original form. "Naked" cartels, those arranged through direct explicit communications between independent firms, are *per se* violations of U.S. law; no amount of evidence concerning circumstances in the industry or effects of the agreement on markets will be considered evidentiary in determining guilt. If the conspiracy is serious enough and the evidence of intent strong enough, corporations and individuals may be charged by the DOJ as a criminal matter. In practice, the DOJ files about 95 percent of all price-fixing cases as criminal matters, and nearly all other antitrust violations are treated as civil matters, for which the burden of proof is merely the preponderance of the evidence. All other parties that bring suits against price fixers, including other federal agencies and state attorneys general, may file only civil complaints.

Although preceded by antitrust laws passed by 13 states of the United States and at least two other countries (France and Canada), the Sherman Act became the first truly effective anticartel statute. By 1897 the U.S. DOJ had successfully prosecuted the first of many domestic price fixing conspiracies. The famous *American Tobacco* case decided by the Supreme Court in 1911 had some international elements; two of the defendants were UK firms. However, except for the period of five years following the end of World War II, the DOJ prosecuted very few international cartels, even though the Sherman Act applies to any conspiracy that affects U.S. markets. It appears that international cartels formed between 1945 and 1990 were few, very well

[41] Recall that under the U.S. DOJ's definition of "foreign" or international at least one target (corporate or individual) of an investigation or conviction must have non-U.S. registration, citizenship, or residence. Global cartels are subsets that aimed at affecting prices in three or more continents or consist of members drawn from three or more continents, usually Europe, North America, and Asia.

hidden, or had no U.S.-corporate membership. Moreover, in the three or four cases of global cartels that were prosecuted between 1950 and 1995, the DOJ lost the cases because the witnesses were foreign or key evidence located abroad could not be obtained by prosecutors.[42]

The notable success in prosecuting global cartels after 1995 may be traced to several improvements in the law and in investigatory techniques (Connor 2001, Baker 2001). First, the Sherman Act's penalties were steadily increased by amendments in 1955, 1974, 1987, and 1990 (Table 8). In 1974, corporate fines were increased twenty-fold, and personal participation was made a *felony* (prison sentences were raised from a maximum of one year to three years). In 1987, a federal judicial commission further raised the possible fines on corporations up to a maximum of double the cartel's overcharge, a level that could far exceed the previous statutory cap of $1 million; larger personal fines also became feasible.[43] In 1990, the Sherman Act received a centennial "birthday present" of yet larger statutory fines from the Congress. Thus, from 1974 to 1990, the maximum corporate liability for U.S. price fixing rose from $50,000 to *twelve times* the cartel's overcharge.[44]

Cohen and Scheffman (1989) provide a useful survey of increases in U.S. price-fixing fines. From 1955 to 1974, the average fines for corporations and individuals amounted to only 0.4% of the cartel's affected sales. During 1974-1980, when the maximum corporate fine was raised to $1 million, the average price-fixing fines rose to 1.4% of affected commerce. During this period the U.S. DOJ issued guidelines that specified 10% of affected sales as the "base fine," with two aggravating factors and two factors permitting downward departures from the base fine. Thus, on average, corporations received 86% discounts from the base fine in 1974-1980.

In 1984, it became possible to fine price fixers "double the harm," that is, twice the overcharges; this power was rarely applied in practice. A 1988 survey reported average corporate price-fixing fines of only $160,000 per company. Moreover, instead of 200% as permitted by law, Sheer an Ho (1989) found that the average 1988 corporate fine was a mere 0.36% of the overcharges. In 1987, the recommendations of the U.S. Sentencing Commission were made law (USSC 1997). The guidelines for price-fixing fines were strongly affected by submission of DOJ staff and optimal deterrence theory. These sentencing guidelines, still currently in force, propose a base fine of 20% of affected sales (which is calculated on double-the-harm for an *assumed* 10% overcharge).

[42] In the *Industrial Diamonds* cartel case, the case was dismissed in large part because a key witness residing in Europe refused to testify and many inculpatory documents were in South Africa beyond the reach of U.S. subpoenas.

[43] Under the so-called "alternative sentencing provisions" of 18 U.S.C.S 3571 (d), the U.S. DOJ can calculate a violator's base fine using the overcharge of all the cartel's members, not just a single company's (Spratling 1997).

[44] Government fines are based on double the overcharges to U. S. buyers, but the DOJ has the discretion to use global affected sales in place of U.S. sales; the former are typically at least three times domestic sales. Treble damages for direct buyers may be followed by treble damages for indirect purchases in state courts or *parens patriae* suits. The U.S. Government has not used global sales to calculate the base fine up to now; it only uses large global sales to adjust the culpability multipliers (Kovacic 2002). However, it may still have the *power* to use global sales for base fines should it wish.

Table 8. Criminal Penalties for Price Fixing, U.S. Sherman Act, 1890-Present.

Year Enacted	Maximum Fines for Companies	Maximum Penalties for Individuals	
		Fines	Prison (Months)
1890	$5,000 per count [a]	$5,000 per count	12[b]
1955	$50,000 per count [a]	$50,000 per count	12[b]
1974	$1,000,000	$100,000c	36[c]
1987	Larger of $1,000,000 or double the harm with multipliers [d]	Larger of $100,000 or 5% of the harm with multipliers [d]	36
1990	Larger of $10,000,000 or double the harm with multipliers [d]	Larger of $350,000 or 5% of the harm with multipliers [d]	36

a In serious cases, prosecutors can file multiple counts against firms involved in one conspiracy. Not used much in recent years.
b Misdemeanor
c Became a felony for individuals.
d The base fines are calculated using either double or 5% of the estimated monopoly overcharge. The base fines are multiplied by upper and lower figures that depend on the degree of "culpability" (larger numbers for several exacerbating factors and smaller ones for extenuating factors). In the 1990s, the multipliers have often been between 1.5 and 3.5. If the overcharge is not known, it is presumed to be 10% of affected sales, which yields a base fine of 20% of affected sales, and a typical fine range of 30% to 90% of cartel sales. However, if a cartel creates a 25% overcharge, then the base fine is 50% of affected sales and the final fine range will be 75% to 225% of sales. "Sales" is usually U.S. only, but may be global cartel sales. In rare cases individuals can be fined up to $25,000,000 depending on their cartel's overcharge amount.

The culpability factors (increases for recidivism, high-level-management involvement, and big rigging; decreases for cooperation) then allow for a range of corporate fines between 20% and 80% of affected sales. In theory, corporations are liable for at least 14 times higher fines after 1987 than during the late 1970s; in practice, the DOJ typically requests very large discounts for minimally cooperative firms.

Second, around 1993 an enforcement policy shift took place in the DOJ that placed a higher priority on investigating international antitrust violations and that instructed the FBI to employ all the tools of their trade to collect evidence. Prior to 1993, price-fixing fines had been cheerily paid with all the embarrassment associated with a parking ticket. The FBI had treated price fixers with the gentleness accorded a shoplifter. But after 1992, price-fixing probes had all the trappings of a major conspiracy by the worst types of organized criminals. Armed with intimidating new powers to sanction firms and their managers, prosecutors bargained hard to obtain confessions and to "flip" conspirators into useful witnesses against their co-conspirators. The 1993 revision of the DOJ Corporate Leniency Program described below was a particularly important investigative innovation. Prosecutors became sophisticated in their use of amnesty, leniency, or other blandishments to induce cooperation. By 2001, nearly 70 percent of all corporate price-fixing defendants were foreign-based.

Third, the DOJ has introduced a number of methods of cooperating with other jurisdictions (ICPAC 2000, Pate 2003). Protocols between agencies permit sharing of information on cartel investigations or enforcement actions, subject to restrictions set by national laws on confidentiality. More formal treaties (Mutual Legal Assistance Treaties) can facilitate joint investigations, and other bilateral treaties can legalize extradition of cartel managers indicted for antitrust crimes. Informal regular meetings of enforcement officials have fostered the exchange of effective investigatory techniques, such as the corporate leniency program. The

International Competition Network has been joined by dozens of antitrust authorities; top officials now meet once a year to exchange views and initiate projects of mutual interest.

The U.S. DOJ's criminal price-fixing record is summarized in Table 9. During 1980-1999, the Antitrust Division convicted more than 50 price-fixing crimes per year on average.[45] Until late 1996, nearly all the cases prosecuted were domestic schemes that involved modest sales in the affected markets. Indeed, during the 1980s, more than 80 percent of the price-fixing cases involved bid-rigging, mostly construction firms colluding on government projects or suppliers to local school districts; fewer than 15 percent were directed against conventional corporate cartels.

After 1990, enforcement patterns returned to the more traditional pattern of prosecuting horizontal collusion by corporate perpetrators. More importantly, starting with the lysine cartel in September 1996, the most important U.S. price-fixing convictions have been global conspiracies in food-and-feed ingredients. Ten such cartels were fully or partially prosecuted during, 1996-1999.[46] Total corporate fines imposed in the ten food-and-feed cartels were $1,326 million on 33 multinational corporations (five more companies were granted amnesties). In addition, the U.S. DOJ has convicted members of ten global cartels in other markets. However, the food-and-agricultural cartels accounted for 81 percent of the cartelized sales and 85 percent of all the fines on discovered international cartels.

During 1970-1999, the DOJ has obtained corporate fines from a high share (83 percent) of the corporations found guilty of criminal price fixing (Table 9). The global cartels prosecuted in the late 1990s were clearly all fairly serious cases because all of them resulted in fines for the corporate participants.[47] Indeed, *all* cartel members were fined except for those offered amnesty (Nanni 2002).[48]

Table 10 summarizes the sanctions imposed by the DOJ on violators involved in international price fixing since 1990 – 36 cases in all. A total of 118 corporations have paid fines or were liable to pay fines.[49] Of the 118 guilty firms, 23 were not fined; they either received amnesty or in a few cases settled with the government through non-monetary means such as consent decrees. As not all of these cases are closed, it appears that another 35 or so companies will either plead guilty or insist on a trial 1n 2003-2004. Thus, the average international cartel case generates about four corporate convictions.

[45] The DOJ convicts more than 80% of those indicted for antitrust. Nearly all convictions are through plea bargains rather than trials.

[46] Data in this paragraph from Connor (2002: Tables 3, A.1, A.2, and A.3.).

[47] Table 10 includes every global cartel case filed after September 1996 and largely concluded by mid 2003.

[48] Only one corporate cartel participant risked a jury trial, and it lost badly. Mitsubishi Corp. had very little direct involvement in the global graphite-electrodes cartel, yet it was fined $134 million in 2001.

[49] A few firms were fined more than once. These are double counted.

Table 9. Fines or Prison Sentences Imposed in All U.S. DOJ Price-Fixing Cases, 1970-2003.

Years	Total Criminal Cases Filed	Cases in Which Fines Imposed	Cases in Which Prison Sentences Imposed			
			Total Number	Largest Sentences		
				< 1 yr.	1-2 yrs.	2+ yrs.
			Number			
1970-1979	176	156	25	24	0	1[b]
1980-1989	623	513	196	183	10	3
1990-1999	416	324	61	47	12	2
Global only:						
1990-1995	0	0	0	--	--	--
1996-1999	9	9	3[c]	2	1	1
2000-2003	11	11	6[e]	3	2	1
			Percent of Total			
1970-1979	42[a]	88.6	14.2	96.0	0	4.0[b]
1980-1989	84[a]	82.3	31.5	93.4	5.1	1.5
1990-1999	68[a]	77.9	14.7	77.0	19.7	3.3
Global only:						
1990-1995	0	0	0	--	--	--
1996-1999	--	100	44.4	50	25.0	25.0
1999-2003	--	100	54.6	50	33.3	16.7

-- = not available

Sources: Posner (2001:45), Connor (2001), Appendix Tables 2 and 10.

[a] Proportion of criminal cases to total DOJ antitrust cases.

[b] An unusual case; individual found guilty of racketeering as well as price fixing.

[c] Seven persons have been indicted in a fourth, the sorbates case, but are fugitives as of 2003.

[d] Global cartels calendar year, others federal fiscal year Oct 1-Sept. 30.

[e] Six persons in three cases are indicted fugitives.

DOJ fines on the 36 international cartels prosecuted since 1990 have amounted to $2,250 million (Appendix Table 2). With 95 companies fined, the average per company is $24 million, but the range is quite large and skewed toward smaller fines. Twenty of the companies or 21% received fines of $1 million or less, whereas 38 (40%) companies are members of the DOJ's "Ten-Million-Dollar Club."

The temporal pattern of U.S. fines on the 36 international cartels is shown on in Figure 9. Fines imposed on the four cartels first prosecuted in 1992-1994 amounted only to $23 million (these are omitted from the figure). Beginning in 1995, the pattern is strongly affected by five big cases: lysine ($92.5 million in 1995), citric acid ($105.4, 1996), graphite electrodes ($433.3, 1998), vitamins ($876, 1999), and the USAID/Egypt construction case ($141.2, 2000)[50]. Indeed, these five cases account for 75% of the fines imposed during 1992-2003.

[50] Te USAID-construction case includes restitution, which is treated in this paper as equivalent to a monetary fine.

Clearly, 1998-99 was the peak year for U.S. fines from international corporate price fixers. After 1999, the total fines imposed trail off significantly. In the first half of 2003, only one cartel was fined by the DOJ ($5 million). While this drop off may signal a change in federal Anticartel policy, most of the decline seems to be attributable to the size of affected sales. It is likely that the number of international-cartel cases to be filed in 2003-2004 will be high; in July 2003, the DOJ had 120 grand juries enpummeled on price-fixing allegations, of which 50 were international cartels (Pate 2003).

Prison sentences can be imposed by U.S. courts, which almost always follow the DOJ's recommendations in these matters.. The threat of prison is still reserved for the most serious types of price-fixing, namely, those involving large economic injuries or cases in which the cartel managers resisted pleading guilty and cooperating with prosecutors.

Historically, the DOJ sought prison sentences for individuals in a minority of price-fixing cases; the rate was 23% all price-fixing cases during 1970-1999 (Table 9). But in the case of *global* cartels, the DOJ obtained prison sentences in 50% of the cases since 1995. Half of the prison sentences are at the felony level of more than 12 months. On average, about three executives plead guilty or are indicted per global cartel. As of 2003, about 30% of the indicted executives not yet sentenced were residing outside the United States and were fugitives; another 10% were U.S. citizens awaiting trial (Appendix Table 10). The share of long sentences imposed on the cartel ring leaders is particularly striking. In the one case where the managers resisted making deals for pleading guilty, the lysine cartel, the three ADM executives lost at trial and were sentenced to a collective 99 months in prison; ADM's Vice Chairman was the first person in antitrust history to receive the maximum 36-month sentence.

Criminal indictments and convictions of food-and-agricultural price fixers display an interesting geographic pattern (Table 11). Since 1990, total of 559 corporations and 99 individuals have been sanctioned for their roles in about 65 international cartels by U.S. or EU authorities. (There is some double counting of corporations sanctioned for the same infraction by both jurisdictions). The majority of corporate cartelists come from just four countries: Germany, Belgium, the United States, and Japan. The top ten countries account for 80% of all international cartel participants.

Table 10. Fines and Sentences Imposed on International Cartels by U.S. DOJ, 1990-2003.

Case First Filed	No. of Fines		Prison Sentences Imposed			
	Corporate[a]	Persons [a]	Year	No. Persons	No. Months	Max. Months
1993 Aluminum phosphide	3[2]	0[3]	--	0	0	0
1994 Fax thermal paper rolls	6	1	--	0	0	0
1994 Plastic dinnerware	3	7	1996	7	80	21
1995 Explosives	4	2[1]	1996	1	10	10
1995 Ferrosilicon	2[2]	1	1995	1	4	4
1996 Lysine	5	6[1]	1999	3	99	36
1996 Citric acid	5	4	--	0	0	0
1966 Tampico fiber	3[1]	0	--	0	0	0
1996 Laminated tubes	0	0	--	0	0	0
1997 Sodium gluconate	3[2]	5	--	0	0	0
1998 Anti-anxiety drugs	4	0	--	0	0	0
1998 Heavy-Lift marine construction	1[1](+6)	1[5]	--	0	0	0
1998 Heavy-Lift marine transport	2[1](+2)	2	--	0	0	0
1998 Graphite electrodes	7[1]	3	1999	2	26	17
1998 Sorbates	5[1](+1)	0[8]	Pending	--	--	--
1998 Niacin (vitamin B3)	4	2	2000	2	20	12
1999 Vitamins A,E,C,B1,B5	7	6[2]	1999	6	22.5	5
1999 Choline chloride (B4)	2	05	--	0	0	0
1999 Sodium erythorbate	1[1]	0	--	0	0	0
1999 Maltol	1[1]	0	--	0	0	0
2000 Bromines	1[1](+1)	0	--	0	0	0
2000 Construction, USAID	4[1]	2[1]	2001	1	36	36
2000 Bridge, California	1(+1)	1	--	0	0	0
2000 Bridges, cable-stayed	2	1[1]	--	0	0	0
2000 Fine art auctions	1[1]	1[2]	2002	2	18	12
2000 Tactile tiles	1(+1)	0	--	0	0	0
2001 MSG and nucleotides	3[1](+4)	0[1]	--	0	0	0
2001 Isostatic graphite	3[2]	2[3]	2002	1	3	3
2001 MCAA	3[1](+2)	0	2002	3	9	3
2002 Organic peroxides	1[1]	0	--	0	0	0
2002 Carbon cathode block	3[1]	2[2]	Pending	--	--	--
2002 Stamp dealers	0(+8)	0[2]	Pending	--	--	--

2002 Polyester staple	1(+1)	1[1]	--	1	8	8
2002 Carbon electrical products	1(+1)	1[4]	2002	0	0	0
2002 Carbon fiber	1(+6)	0	--	0	0	0
2003 Magnetic iron oxide	1[1](+1)	3[1]	Pending	--	--	--
Total	95[23](+35)	65[43]		32	341.5	36

-- = Not applicable

Source: Appendix tables 2, 3, and 10; Tables A.1-A.12.

[a] Superscripts indicate persons indicted but not convicted (either awaiting trial, awaiting sentencing, or fugitives). Numbers in parentheses are companies known to be under investigation. Some may be fined or imprisoned later.

One unusual case, the *Euro-Zone Banks* prosecution in the EU, distorts the distribution shown in Table 11. Excluding this case causes Belgium, Portugal, and Austria to drop out of the top ten countries to be replaced by Italy, South Korea, and Sweden: the top five countries then become the United States (17% of all corporate violators), Germany (15%), Japan (14%), France (9%), and the UK (7%). The *individuals* sanctioned for initiating and leading international cartels are overwhelmingly from the United States and Japan (65%).

Table 12 examines the nationalities of sanctioned cartelists in the case of global cartels only. The 150 corporations caught participating in these cartels are headquartered in 19 countries, but those from Japan, the USA, Germany, France, and South Korea account for 77% of the total. Relative to the sizes of their national chemical industries, Japan, South Korea, Switzerland, and the Netherlands seem to be overrepresented.

Table 11. Nationality of Participants of International Cartels, 1996-2003.

Country	Indicted by DOJ [a]		Sanctioned by EC [b]		Total Corporations	
	Companies	Persons	Euro-Zone	Other	All	Excluding Euro-Zone
1. USA	56	41	0	14	70	70
2. Germany	16	9	17	47	80	63
3. Japan	37	23	0	23	60	60
4. France	11	5	0	26	37	37
5. UK	7	4	0	21	28	28
6. Netherlands	5	5	15	17	37	20
7. Switzerland	11	5	0	6	17	17
8. Italy	2	2	0	13	15	15
9. South Korea	5	1	0	9	14	14
10. Sweden	1	1	0	11	12	12
11. Austria	0	0	8	10	18	10
12. Norway	3	0	0	6	9	9
13. Belgium	1	1	66	7	74	8
13. Spain	0	0	0	8	8	8
13. Denmark	0	0	0	8	8	8
16. Taiwan	1	0	0	3	4	4
16. Finland	0	0	7	4	11	4
18. Mexico	2	0	0	1	3	3
19. Portugal	0	0	27	1	28	1
20. Ireland	0	0	9	0	9	0
Others	7	2	0	12	17	17
Total	165	99	149	247	559	408

a) Includes guilty corporations granted amnesty and fugitive individuals
b) Includes infringing corporations granted amnesty
c) Eleven countries with one or two sanctioned parties
Source: Appendix Table 2

Table 12. Nationality of Corporate Participants in Global Cartels, 1995-2003

Country	Indicted by DOJ		Sanctioned By EC	Total Corporations
	Corporations	Individuals		
1. Japan	20	20	18	38
2. USA	19	15	10	29
3. Germany	9	6	11	20
4. France	8	4	7	15
5. South Korea	4	1	10	14
6. Switzerland	5	4	4	9
7. Netherlands	3	2	4	7
8. United Kingdom	3	5	3	6
9. Denmark	0	0	2	2
9. Singapore	0	0	2	2
9. Hong Kong	0	0	2	2
9. Taiwan	0	0	2	2
13. Sweden	0	1	1	1
13. Malaysia	0	0	1	1
13. Mexico	0	0	1	1
13. Poland	0	0	1	1
17. Belgium	0	1	0	0
18. Italy	0	1	0	0
TOTAL	71	60	79	150

Source: Appendix Table 2 and 10.

Corporate sanctions need not stop with fines. In a conviction of bid-rigging against the U.S. Agency for International Development on building projects in Egypt, a U.S. court required two convicted firms to pay for large advertisements in the *Wall Street Journal* and *New York Times* that detailed their shameful transgressions. The U.S. DOJ intends to seek similar court orders in appropriate cases. Corporate governance restructurings, divestitures, or disgorgement are possible additional sanctions that courts may require.

The executives who are fined or imprisoned for global price fixing by the U.S. DOJ are often at or near the top of their corporate management structures. Yet, in general the fines collected from individual criminal conspirators are modest compared with their corporate salaries (Table 13). The median fine is $50,000. Moreover, some non-U.S. companies pay the fines for their convicted executives.

However, there are two noteworthy examples of high fines paid by the ringleaders of global cartels. The first was a fine of $10 million paid in 1998 by the German Chief Executive Officer of SGL Carbon, the instigator of the graphite electrodes cartel. He paid a fine well above the statutory cap of $350,000 to avoid a prison sentence. Second, in 2002, the Chairman of

Sotheby's art auction house was convicted at trial for fixing the fees for selling precious works of art. His fine of $7.5 million was the first *litigated* example of the alternative fine statue being applied for price fixing. This statute permits personal fines of up to $25 million, depending on the size of the overcharge caused by the cartel's operations.

The conviction and imprisonment of non-U.S. executives for criminal price fixing by U.S. authorities is an extraordinary development in recent enforcement history (Table 14). During 1995-2002, the U.S. DOJ has arranged guilty-pleas from dozens of top executives who were nationals of 12 foreign countries: Germany, Belgium, the Netherlands, England, France, Switzerland, Italy, Sweden, Canada, Mexico, Japan, and South Korea (Hammond 2002a). Many of these executives worked in the United States, but some traveled from their residences abroad to submit to the jurisdiction of the U.S. court, plead guilty, and pay fines. Although some are indicted fugitives, nearly 80 percent of all price fixers of food-and-agricultural cartels are foreign nationals. Moreover, about ten foreign nationals from Canada, Germany, Switzerland, and Sweden have served significant prison sentences in the United States.

The majority of all price fixers of U.S. prosecuted international cartels are non-U.S. nationals. About 20 executives indicted for global price fixing, the vast majority of them Japanese citizens, have chosen to remain fugitives by residing outside the U.S. territories. On the other hand, at least 12 foreign nationals from Canada, Germany, Switzerland, and Sweden have served significant prison sentences in the United States. One reason for foreigners' willingness to serve time in U.S. prisons is that if they reside or even *pass through* countries that have criminal statutes for price fixing, they may be extradited to the United States (Nanni 2002a). The United States has explicit treaties with Canada, Ireland, and Japan that permit extradition for antitrust violations, though none of these has yet been invoked. In 2002, Interpol added U.S. antitrust fugitives to its "Red Notice" watch list for the first time. When foreign executives plead guilty for price fixing, they are frequently granted the right of free passage across U.S. borders for their cooperation.

In summary, the financial penalties applied by the U.S. DOJ to global price fixers in the late 1990s were unprecedented in their harshness. Despite an increasing number of amnesties, average corporate fines for members of global cartels in the late 1990s were many times higher than the fines collected in 1990-1996, but declined significantly after 1999. While individual fines remained modest on the whole, managers of global conspiracies were more than twice as likely to receive prison sentences as managers of domestic conspiracies, and the length of the sentences has remained high since about 1998. Corporate and individual sanctions have both declined since the peak year 1999. The main reasons for the escalation in fines in the late 1990s were the extraordinary escalation in legal standards, the expanded size of the markets affected, the high overcharge rates, the longevity of many of the conspiracies, and, if truth be told, the rising intolerance of the judicial system for thieves dressed in expensive suits. This rise is especially notable in light of the fact that, correcting for inflation, average corporate fines were essentially unchanged for the first 90 years of the 20th century.

Table 13. Range of U.S. Individual Fines for International Cartel Violations, 1990-2003

Persons	Fine
	$ thousand
1. Robert Kohler	10,000
2. A. Alfred Taubman	7,500
3. Robert Krass	1,250
4. Robert Hart	1,000
5. Michael D. Andreas	350
6. Terrance Wilson	350
7. Mark Whitacre	350
8. Andrea Hauri	350
9. Dianna Brooks	350
10. Akira Nakao	200
11-15. 5 executives	150
16. 1 executive	125
17-22. 6 executives	100
23. 1 executive	90
24-29. 6 executives	75
30-36. 7 executives	50 (median)
37-61. 25 executives	less than 50
Total	24,400
Average (Mean)	400

Source: Appendix Table 10.

Table 14. Average U.S. Criminal Penalties for Price Fixing, 1890-1999.

Years	Fine Per Company	Fines Per Person	Prison Sentence Per Person
	Dollars		*Months*
1890-1899	0	0	0
1900-1919	20,000	0	0
1920-1939	77,800	0	0
1940-1949	52,000	0	0
1950-1959	40,000	NA	0
1960-1969	131,000	NA	0.1
1970-1979	301,000	5,000[a]	2
1980-1989	368,000	NA	4E
1990-1996	1,000,000	67,000	5E
1997[b]	7,000,000	125,000	0
1998[b]	11,000,000	131,000	0
1999[b]	38,000,000	1,871,000	19
2000[b]	24,406,000	0	0
2001[b]	7,094,000	36,250	11
2002[b]	7,007,00	128,050	3

Sources: Posner (2001), Shepherd (1985), Connor (2001), DOJ (2002), Appendix Tables 3 and 10
NA = Not available, but a small amount.
[a] From the *Folding Carton* case.
[b] Global cartels. The corporate lysine case is placed in 1997, but the individual sentences were delayed to 1999.

Canadian Competition Bureau

The Canadian Competition Bureau (CCB) enforces laws similar to those in the United States, and its prosecutions follow those in the United States by a year or so (Connor 2002: Table A.3). Cartel violations are crimes treated in effect as *per se* illegal acts. Persons can be fined and imprisoned, but this power is used quite sparingly. The CCB is a small agency that cooperates closely with the U.S. DOJ. Its indictments of global cartels usually followed those announced by the DOJ after a lag of six months to one year. As in the United States, the CCB has imposed record antitrust penalties, but at a level proportionately lower than the U.S. fine rates, typically representing 10 to 20 percent of Canadian sales during the affected period. In several cases, except for leniency discounts, apparently to save the costs of economic analysis and litigation, the CCB has imposed identical percentage-of-sales fines on each of the conspirators in global cartels.

Canadian cartel-enforcement policy shifted in the mid-1990s. Canadian corporate fines for global price fixing are shown in Table 15. Prosecution began in 1998 with the lysine and citric acid cartels. The fines imposed on these two cartels were almost double the amount the CCB had collected from all other cases in 1990-1997. By mid 2003, Canada had collected C$120 million in fines from 11 global cartels. Of the 11 cartels, nine followed U.S. convictions and the other two EU sanctions.

Only one person, the CEO of a Canadian vitamin manufacturer, has been incarcerated. This sentence of 90 days was the first such punishment in many years. Three more cartel managers, from Germany, Switzerland, and Japan, have paid large fines for their roles in the citric acid, vitamins and sorbates cartels. They paid a fines totaling $750,000, which were the third-largest fines in recent antitrust history.

In addition to global cartels, the CCB fined 20 corporations a total of C$13.4 million for *regional* price fixing (Table 15A). Each of the six international cartels involved manufactured products, some of them imported. Nearly all of the companies fined were non-Canadian, which reflects the very high share of Canada's manufacturing sector that is foreign owned. The three cartels convicted in 1991-1993 (compressed gasses and forest insecticides) operated solely in Canada, but the remaining three cartels (fax paper, choline chloride, and sodium erythorbate) were jointly prosecuted with the DOJ in 1994-2001.

Canada does not automatically prosecute all global cartels that are found guilty in the United States. At least eight such convictions have had no Canadian follow-up. For example, four food-ingredient cartels with relative small affected sales fined by the DOJ in 2001 (e.g., maltol, nucleotides) have not yet been prosecuted in Canada. In four other cases (fine arts, carbon fiber, magnetic iron oxide, and the 3-tenors CD), the U.S. prosecutions were quite lengthy and difficult; the Canadian Ministry of Justice seems to have passed on indicting in order to conserve its resources for cases easier to win.

Canadian fines for international price fixing were imposed predominantly on conspiracies in food and agricultural markets; since 1990, more than 75 percent of the fines have been imposed in these industries. Moreover, the vitamins cartels were by far the largest cartel cases uncovered. The vitamins fines accounted for 48 percent of all cartel fines imposed in Canada since 1990. Although Canada has a relatively small national market and many of the convicted firms sold cartelized products only through exporting (thus, owning few if any assets in Canada that could have been seized in the event of nonpayment of fines), it has been able to mount a surprisingly effective anticartel campaign using very slim enforcement resources. Canada is a model for many smaller industrialized countries that have tough anticartel laws on their books yet have weak enforcement. Unlike many other areas of law enforcement, the returns to Canada's treasury far exceed the outlays.

Table 15. Canadian Global Price-Fixing Convictions and Fines, 1990-2003.

Year	Product:	Company (Ultimate Parent)	Fine
			C$ million
1991-96	Various:	12 Companies	15.0
1998	Lysine:	ADM	9.1
		Ajinomoto	2.3
		Sewon America	0.1[a]
		Kyowa Hakko	0.0[a]
1998	Citric acid:	Jungbunzlauer	1.3[a]
		Haarmann & Reimer (Bayer Corp.)	3.2
		Hoffmann-La Roche	2.0
		ADM	1.3
		Cerestar Bioproducts (Eridania)	0.5
1998	Sodium gluconate:	ADM	0[a]
		Jungbunzlauer	0.6
		Roquette Frères	0.5
		Fujisawa Pharmaceuticals	0.3
		Glucona (Akzo Nobel)	0.2
1999	Chlorine chloride	Chinook Group	1.5
		Russell Cosburn	0
		DuCoa	Pending
		Mitsui	Pending
1999	Vitamin B12	Hoechst/Aventis	0.2
		Rhone-Poulenc/Aventis	0[a]
1999-2000	Vitamins: [b]	Hoffmann-La Roche	34.1
		Kuno Sommer	0.1
		Roland Broenimann	0.2
		Andres Hauri	0.1
		BASF	12.7
		Rhône-Poulenc	9.4
		Takeda	3.6
		Daiichi	1.7
		Eisai	1.3
		E. Merck	0.7
1999-2001	Sorbates:	Ueno Fine Chemicals	1.0
		Daicel Chem. Industries	1.6
		Takayasu Miyasaka	0.2
		Höechst (Aventis)	1.6
		Eastman Chemical	0.5

		Nippon Gohsei	0.1
2000-2001	Graphite electrodes:	SGL Carbon	12.50
		UCAR Intl.	11.00
		Tokai Carbon	0.25
2001	Sodium erythorbate:	Pfizer	1.50
		Fujisawa	0.00 [a]
2001	Isostatic graphite:	Carbone of America	0.30
		Ibiden	Pending
		Toyo Tanso	Pending
		Tokai Carbon	Pending
		Nippon Steel	Pending
		SGL Carbon	Pending
2002	Vitamin B3	Degussa	1.6
		Lonza	0.7
		Napera	0.2
		Reilly	0.02
2003	Methyl glucamine	Aventis	0.34
		E. Merck	0 [a]
	TOTAL	48 corporations	120.0

Source: Canada Competition Bureau and Department of Justice: Fines chart dated November 23, 1999, News Releases, and Statements of Fact.

[a] Discounted because of early cooperation with the Ministry.

[b] Investigations continuing as of early 2003. Two individuals were fined C$250,000 each (not shown).

[c] Includes restitution

Table 15A. Canadian Other International Price-Fixing Convictions and Fines, 1990-20

Year	Product	Company (Parent)	Fine
			C$ million
1991	Compressed gasses	Canadian Oxygen	0.5
		Union Carbide	1.2
		Canadian Liquid Air	1.2
		Liquid Carbonic	1.2
		Air Products	0.3
			4.4
1993	Insecticides, forest, synthetic	Chemagro (Bayer)	1.3
		Sumitomo Chemical	0.8
			2.1
1993	Insecticides, BT, forest	Abbott Labs	1.4
		Chemagro (Bayer)	0.5
			1.9
1994	Thermal fax paper	Kanzaki Paper Mfg.	0.44
		Mitsubishi Paper	0.62
		Mitsubishi International	0.68
		Kangaki Specialty Papers	0.68
		Rittenhouse Ribbons	0.07
			2.49
1999	Choline chloride, No. Am. branch	Chinook Group	1.5
		DuCoa	Pending
		Bio-products (Mitsui)	Pending
			1.5
2001	Sodium erythorbate	Pfizer Corporation	1.0
		Fujisawa Pharma.	0
		Cheil Jedang	0
			1.0
	TOTAL		13.4

Source: Tables A.9 and A.12.

European Commission

Like Canada, the European Commission's Directorate General for Competition (DG-4) has cooperated with U.S. and other national antitrust agencies, but it is also terribly understaffed and even slower to act.[51] The EC's international-cartel decisions take an average of four years

[51] The DG-COMP has about 500 professionals, half the Antitrust Division's number, but broader legal responsibilities (state subsidies, issuing negative clearances, etc.) than the Division. Moreover, the U.S. DOJ has dedicated investigators in the FBI, whereas DG-4 does its own probes.

after U.S. prosecutions are announced (Connor 2002: Table A.3). The EC's lysine decision came eight years after the U.S. DOJ began investigating. Unlike the United States, Canada, and some of its member states, EU law treats antitrust violations solely as a civil infractions by business entities.[52] Individual conspirators are not personally liable for monetary penalties or prison sentences (Connor 2001:81-91). In this sense the powers and procedures of the DG-IV resemble those of the U.S. Federal Trade Commission more closely than the U.S. DOJ's Antitrust Division[53].

Prior to the strengthening of the Sherman Act's sanctions during 1974-1990, the EC's formal authority to impose fines for major cartel violations was considered superior to the DOJ's powers. Since the signing of the Treaty of Rome, corporate members of cartels have been subject to maximum fines of 10 percent of sales in the year or years prior to an effective price-fixing agreement. The EC's fines can be based on the *global* sales of an offending firm in *all* its lines of business, but in practice cartel fines are mostly based upon a violator's EU sales in the affected line of business only (Connor 2001:401-407).[54]

The difference between U.S. and EU powers to fine corporations may be easily illustrated using a hypothetical but realistic example. Take ADM's situation in the citric acid market during the mid 1990s: annual global sales of about $10 billion and citric acid sales of about $200 million per year (distributed equally between North America, Western Europe, and the rest of the world) out of $900 million in global citric acid sales. Then consider three cartel scenarios: (I) a short-lived cartel of modest effectiveness (a 10-percent overcharge), (II) a cartel of a three-year duration and highly effective (30 percent), and (III) a ten-year, highly harmful cartel. The method of calculating antitrust fines was made more exploit in an EC decision of January 1998 (Wils 1998).

Table 16 demonstrates ADM's maximum antitrust liability under current U.S. and EU laws. By assumption, the overcharges on ADM's buyers in the EU and USA are identical and equal to $6.7 million per year. Looking at cartel scenario I (a short, weak conspiracy), ADM would be liable for a top U.S. fine of $13 to $60 million, depending on the company's degree of culpability (i.e., whether it was the cartel's initiator, chief enforcer, or failed to cooperate with the DOJ's investigation).[55] In the EU, ADM would be liable for simply an amount equal to its monopoly profits of $6.7 million, unless the EC took the unusual step of invoking global sales to calculate the cartel fine. In the latter case, the EC could impose a $1,000-million fine on ADM. Thus, the sales base employed by DG-IV has a critical effect on whether EU fines can be higher or lower than comparable U.S. fines.

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[52] Besides the USA and Canada, eight other countries provide for criminal sanctions: Austria, Germany, France, Norway, Ireland, Slovakia, Japan, and South Korea. Australia and the UK are considering such laws (Hammond 2002).

[53] Like the FTC, the EC competition directorate investigates allegations of antitrust violations, holds hearings in which defendants can present their side of the case, makes an initial determination of guilt, recommends sanctions, has those decisions approved by the full commission, and may have its decisions appealed by the guilty parties to two higher courts.

[54] Serious consideration is begin given to imprisonment and personal penalties (Wils 2001).

[55] Under the Sentencing Guidelines approach, the U.S. DOJ arbitrarily adopts 20 % of sales as the base fine, and then multiplies this base by the culpability factor, which for global cartels in the late 1990s ranged from 1.5 to 4.0. Under the simpler felony approach, ADM is liable for twice the overcharge.

Examining the scenario with the long-lasting, high-overcharge assumptions, the DOJ can request greatly enlarged fines of $200 to $600, because the overcharge in scenario III is 30 times larger ($200 million) than that for scenario I ($6.7 million). However, the EC's ability to fine is severely hampered by its 10-percent-of-sales rule. In particular, under its usual practice, the EU's top fine on ADM would be quite a bit lower than ADM's monopoly profits from its EU operations during the cartel. That is, based on jurisdictional sales only, the EU's ability to disgorge cartelists' illegal profits is weak. It is in such cases that the EC is most likely to consider ADM's global sales as a basis for its antitrust penalties.

Table 16. Maximum U.S. and EU Fines for a Company with $200 Million in Affected Sales in a $900-million Global Cartel.

Cartel Scenarios	Economic Harm to Company's Buyers	United States		European Union [a]	
		Sentencing Guidelines	Felony Guidelines	Cartelized Market Sales	Group Sales of $10 Billion
	Million dollars				
I. One year, 10% overcharge					
A. Jurisdiction sales basis [b]	6.7	20-60	13.3	6.7	333
B. Global sales basis [c]	20.0	60-180	40	20.0	1,000
II. One year, 30% overcharge					
A. Jurisdiction sales basis [b]	20.0	20-60	40	6.7	333
B. Global sales basis[c]	60.0	60-180	120	20.0	1,000
III. Ten years, 30% overcharge					
A. Jurisdiction sales basis [b]	200.0	200-600	400	6.7	333
B. Global sales basis [c]	600.0	600-1,800	1,200	20.0	1,000

Source: Connor (2001:87).
a Assumed that the sales of the cartelized product were $66.7 million in the EU out of $200 million in the world.
b Assumed that of $900 million in global sales of cartel, $300 million occurred in the U.S. and $300 million in the EU. The company has a 22% share of each geographic market. The USSG (1997) multipliers are 1.5 to 4.0, depending on the seriousness of the offense.
c Rarely applied by U.S. authorities. More commonly applied (but in a minority of cases) by the European Commission.

As in all jurisdictions, maximum fines are one thing and actual fines another. The EU has recently adopted guidelines for calculating firm-by-firm discounts from the maximum statutory fines. First, the DG-IV considers the "gravity" of the offense; cartels are always the "most serious" (the highest of three levels) type of antitrust infringements, and large overcharges that are geographically widespread only add to the gravity. Second, large companies are fined double the amount of "small" ones: in the lysine case the threshold was €3 billion. Third, fines are increased by 10 percent per year for each year the cartel is effective. Fourth, these three factors result in a "base fine" that is adjusted upward by 50 percent for cartel leadership and downwards 20 percent for passivity. Fifth, a 10-percent discount is given for immediate cessation of the conspiracy. Finally, under the Leniency Notice, violators are given discounts for

their degrees of cooperation, from 10 percent for minimal cooperation to 50 percent for the most cooperative. In rare cases, amnesty is granted.

The description just given for fine-setting probably overstates the degree of precision of the process. Moreover, firms can and usually do appeal the EC fines to the European Court of First Instance, where they often receive modest downward adjustments. Nevertheless, the fines meted out by the EC for 15 cases of global price fixing have reached an impressive $1,852 millions (Table 17). The first large cartel fined was lysine, with a total of nearly $100 million.[56] In 2001, decisions were reached in four huge cartel cases with total fines of $1,115 million (together with other antitrust fines, DG-IV imposed €1.8 billion in fines in 2001). In 2002, the EC announced an historic decision to fine four companies $250 million for global price fixing in the market for the amino acid methionine; this is the first time that the EC has prosecuted a global cartel prior to a U.S. conviction. Another 12 or more global cartel cases under investigation are likely to result in continuing large fines for the next few years.

Table 17. EC Fines on International Cartels, 1990-2003

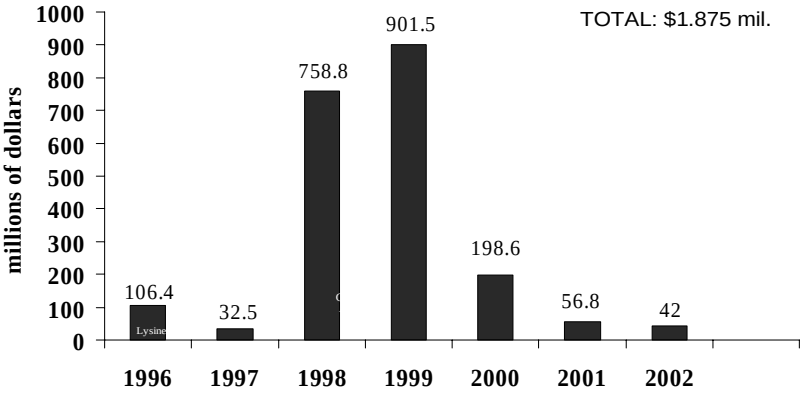
Year [a]	Product	Number of Companies	Fine
	Global Scope:		*Million dollars*
1992	Europe-Central W. Africa shipping	13	15.3
1992	French-W. Africa shipping	17	15.3
1998	TACA North Atlantic shipping	15	236.0[b]
2000	FETTSCA Far East shipping	15	7.7
2000	Lysine	5	97.9
2001	Citric acid	5	120.4
2001	Vitamins	9	756.9
2001	Sodium gluconate	6	51.2
2001	Graphite electrodes	8	186.9
2002	Methionine	3	250.4
2002	Nucleotides	3	21.1
2002	Isostatic graphite	6	50.9
2002	Extruded graphite	1	8.8
2002	Fine art auctions	1	20.1
2002	Methyl glucamine	1	2.8
2002	MCAA	2	10.0
	Total 16 Global Scope	110	1,851.7
	EU Regional:		
1990	Soda ash	2	65.0
1994	Steel beams	14	110.9
1994	Cartonboard	19	117.6

[56] The EC's lysine investigation was launched one year after the FBI raids were publicized and four years after the FBI's probe began. The EC's decision was announced four years after the DOJ's convictions.

1994	PVC plastic	13	20.3
1996	Ferries, channel	5	0.7
1998	Stainless steel, flat	6	25.4
1998	District heating pipe	10	77.3
1998	British sugar	4	11.0
1999	Ferries, Adriatic	7	59.6
2000	Euro-Zone banks	5	89.7
2000	Cement, EU	23	103.3
2000	Carbonless paper	10	282.6
2001	Beer, Belgium, store brand	4	1.6
2001	Zinc phosphate	6	12.0
2001	Danish air route	2	45.1
2002	Plasterboard	4	479.3
2002	Compressed gasses, Netherlands	8	22.9
2002	Mobile phones, Netherlands	5	92.1
2003	Beer, Belgium, HORECA	2	79.3
	Total 19 regional	149	1,797.0
	EC 35 total	259	3,648.7

Source: Appendix Table 11 and 12.
[a] Year in which fines announced. Euros translated into U.S. dollars using that date.
[b] Fines nullified by appeal to the European Court in September 2003.

Figure 10: International Cartel Fines Collected, U.S. Dept. of Justice, 1995-2002 Calendar Years



In addition to global cartels, the EC has been busy with cartels organized within its jurisdiction. Most of these cartels involved conspiracies across national borders, but five of the 19 operated within one member state (Table 17). The number and size of the EU regional cartels

is close to that of the global cartels. Total fines imposed ($1,797 million) was only slightly less than those imposed on the global cartels. The total of EC fines on all types of international cartels is $3,648.7 million, which is 60% more than the DOJ's total over the same period.

The temporal pattern of the EC's international cartel fines is shown in Figure 10. The years 2000-2002 were clearly banner ones; the years 2000-2002 account for 73% of the 1990-2003 total. The 2001 peak year for the EC follows that of the DOJ by two years. However, the size of the fines in 2003 appears to be slowing relative to 2002.

Four of the five cartels prosecuted by the EC in 2000-2001 operated in the food-and-agriculture sector. As in the United States and Canada, these cartels accounted for the lion's share of fines: 85 percent in the EC case. A recent survey of EC competition-law enforcement did not anticipate these cases (Buccirossi *et al*. 2002).[57]

Other National Competition Authorities

This section examines the recent but accelerating number of international-cartel prosecutions of national authorities other than the United States and Canada.[58] These agencies have *fined* a total of 40 international cartels and as of 2003 were *investigating* another 11 international cartels. These 51 cartels comprised 29% of the data set constructed for this paper (Appendix Table 3). The first such cartel to be fined was the glass-containers case reported by the national antitrust authority of Italy in July 1997. In the late 1990s, Italy was by far the most aggressive in prosecuting internationally cartels, with nine of the 15 cartels cases (Table 18). In all, Italy has prosecuted 16 international cartels since 1997 and is investigating one more; Italy accounts for 35% of the cartels discovered by the "other" national authorities.

Italy's rate of discovery has diminished to about two cases per year since 1999, but the national antitrust authorities in the Netherlands and France have become newly energized. All of the Netherlands's authority's cases were launched since mid-2001, shortly after its investigative powers were strengthened. Much of its work is consumed by a major scandal involving big rigging by scores of construction companies of Dutch government building projects. The new found assertiveness of the French national authority is also impressive given that council's subjugation to the Ministry of Finance. Nearly all other national authorities have a large measure of independence from government ministries.

In addition to the 40 cases generated by nine EU members, there are 11 cases associated with eight non-EU countries (Hungary and the Czech Republic will soon join the EU). All of the European cases have involved cartels that fixed prices inside their national borders.[59] Most of the remaining cases are also national-scope conspiracies. The only global-cartel cases prosecuted by a national authority outside North America were lysine, vitamins, and graphite electrodes.

[57] These authors concluded that the DG-IV's priorities in the agricultural-inputs industry were tacit collusion. Overt price fixing was mainly a concern in the food processing industries.

[58] Besides all the usual journalistic sources, information on these cases was supplemented by visiting the web sites of more than 25 national authorities, many of which have extensive translations into English. Another important source were these agencies annual reports to the OECD, which tend to highlight most of the bigger cartel cases.

[59] One possible exception is the calcium carbide case currently being investigated by Norway and Germany.

Mexico imposed a negligible fine on a couple of the lysine conspirators in the late 1990s, and Brazil is currently probing the vitamins cartel. However, the only antitrust authority to impose substantial fines on global cartels was the Korean Fair Trade Commission (KFTC). In 2002, the KFTC imposed fines of $8.5 million on six companies guilty of graphite-electrodes price fixing and $3.1 million on six vitamins manufacturers. This is a remarkable victory for a new Asian authority.

The fines imposed on international cartels by European and Asian national authorities are summarized in Table 19. More than 350 companies have been fined, of which one-third were foreign, a total of $1,446 million by mid-2003.

Table 18. International Cartels Discovered by Other National Authorities.

Country	Date of Discovery					Total
	Fined Cartels			Investigations Only		
	1997-1999	2000-2001	2002-2003	2000-2001	2002-2003	
EU:						
Netherlands	--	2	2	--	3	7
Italy	9	5	2	--	1	17
UK	--	--	1	--	1	2
Germany	1	--	1	--	1	3
France	1	--	4	--	--	5
Spain	1	--	--	--	--	1
Sweden	--	1	1	--	--	2
Norway	1	--	--	--	1	2
Finland	--	--	--	--	1	1
Non-EU:						
Brazil	--	--	--	--	1	1
Mexico	1	--	--	--	--	1
Australia	1	--	1	--	--	2
Korea	--	1	2	--	--	3
Chile	--	--	--	--	1	1
Czech Republic	--	--	1	--	--	1
Hungary	--	--	--	--	1	1
Japan	1	--	--	--	--	1
Total	16	9	15	0	11	51

Source: Appendix Table 3.

Table 19. Fines Imposed on International Cartels by Other National Authorities

Case Decided	Country	Companies Fined		Amount
		Domestic	Foreign	
		Number		*$million*
Global scope:				
1998 Lysine	MEX	0	2+	0.1
2001 Vitamins	AUS	0	4	
March 2002 Graphite electrodes	KO	0	6	8.5
April 2003 Vitamins	KO	0	6	3.1
National scope:				
7/97 Glass containers	IT	3	1	21.6
10/97 Recorded music	IT	0	5	4.5
3/99 Drugs, cholesterol	IT	3	2	0.1
3/99 Drugs, respiratory	IT	1	1	0.4
5/99 Hydro power equipment	NO	2	0	2.6
5/99 Water heater gas	IT	4	3	7.3
10/99 Cell phones	IT	1	1	80.7
11/99 Concrete	DE	64	4	192.6
11/99 Military fuel	JP	10	1	18.1
12/99 Drugs, obesity	IT	1	1	1.6
2/00 Auditing services	IT	0	6	2.2
3/00 Infant formula	IT	3	3	3.0
5/00 Elevator repair	IT	1	3	8.4
6/00 Retail gasoline	IT	4	4	290.0 [a]
6/00 Retail gasoline	SW	1	4	84.4 [a]
7/00 Match distribution	IT	3	1	0
11/00 Radiological media	IT	2	3	3.9
6/01 Military fuels	KO	3	2	146.3
6/01 Retail gasoline	ES	1	2	3.6
1/02 Construction	NL	25+	25+	Pending
4/02 Generic drugs	UK	3	3	Pending
5/02 Power transformers	AU	2	1	12.4
6/02 Appliances distribution	FR	1	7	33.6
6/02 Retail gasoline	NL	1	1	1.1
7/02 Property insurance	DE	12	1	Pending
9/02 Ball bearings	FR	5	1	18.8
9/02 Retail gasoline	CZ	1	5	10.3
10/02 Cement	HU	1	1	0.5
11/02 Bicycles	NL	4	1	Pending
11/02 Concrete engineering	NL	1	1	Pending
11/02 Toys & games	UK	2	1	43.7
12/02 Athletic tracks	NL	4	1	Pending
12/02 Mobile phones	NL	1	4	92.1
12/02 Retail gasoline	CL	1	3	Pending
1/03 Prawn fishing	NL	12	4	15.0

2/03 Construction	NO	2	2	Pending
3/03 Asphalt	SW	9	2	189.3
3/03 Cigarettes	IT	1	1	62.4
3/03 Diesel distribution	IT	16	3	0.5
4/03 Beef	FR	6	0	18.0
4/03 Cement, Lombardy	IT	10	1	Pending
4/03 Diabetes test device	IT	1	4	35.2
4/03 Compressors	AU	1	2	0.5
6/03 Asphalt paving	FI	5	1	Pending
6/03 Insurance	NL	?	1	Pending
TOTAL		236	121	1,446.2

The total fines imposed (a few are under appeal) is somewhat less than either the EU or United States, but an impressive amount given the restricted size of these national economies and the relatively few years of active enforcement. The average fine imposed was $38 million, but the median is much lower (about $11 million).

A fairly large share of these cases involved government bid-rigging schemes. Several cases dealt with sales of drugs or diagnostic devices to national health programs; asphalt, concrete, and other public construction services; and fuels purchased for the military. Seven cases focused on retail gasoline prices; many of these followed recent privatizations of national petroleum companies and withdrawal of government price regulation.

Private Suits

Suits by injured private buyers of cartelized products were authorized by the Sherman Act of 1890 (Connor 2001:70-71). These civil suits are often called treble-damage actions because of the upper limit of the recovery allowed under the law. In theory, these awards provide for compensation (the overcharge), for the costs and risks of private investigation and legal costs, and for punitive a punitive component (Hovenkamp 1999). Plaintiffs have the burden of proof that the illegal activity occurred, that the economic harm was a direct result of the illegal conduct, and of the size of the damages; proof requires the use of reasonable methods and the support of the preponderance of the evidence. Most private suits are organized as class actions, and most are settled out of court with few details about the evidence publicly revealed.[60] The large majority of cartel civil suits follow criminal convictions; a small number settle prior to convictions; and a few successful private suits have no parallel government cases.

There is a lively debate in the law-and-economics literature over the desirability of treble damages suits. Papers published in the 1970s and 1980s expressed concern that treble damages would encourage buyers to delay suing price fixers in order to increase their legal recoveries – a

[60] Plaintiffs that remain members of the federal class have their negotiated settlement approved by the supervising judge, but these decisions are typically not published or avidly available. Even for some large court-approved settlements, press reporting is spotty. Settlements by opt-out plaintiffs are strictly confidential unless recipients are obligated to report a recovery to their shareholders.

perverse incentive (Besanko and Spulber 1990). Other researchers have suggested "neutral" welfare consequences; that is, private suits result in pure income transfers with no social welfare impacts. The latest word in this stream of the literature is Besanko and Spulber (1999). Their game-theoretic model with apparently reasonable assumptions deduces that treble damages generally leads to positive welfare increases if the probability of conviction and the multiple of damages recovered is high enough.

Despite a thorough search of business and legal news sources, satisfactory information could be gleaned about only 17 private U.S. federal-court settlements or trials since 1990, where the defendants were alleged members of international cartels. Nine were global and eight were regional NAFTA area cartels. Counting the main vitamins case as one observation, information is available on 47% of U.S.-prosecuted global cartels and 36% of the NAFTA regional cartels. Of the remainder, some have private suits pending resolution, some have been settled but were not newsworthy, and a small number had no private suits filed (e.g., in the USAID-construction case the federal government was the only injured party).

Private parties recovered about $3.4 billion in the nine global cases (from $1 million in sodium gluconate to $1630 million in vitamins). Defendants in the eight regional cartels paid about $550 million to plaintiffs, the largest being cosmetics ($199 million) and choline chloride ($147 million). Even though both types are based on only U.S. affected commerce, the average global settlement was eight times as large as the average regional settlement.

Are these recoveries big or small? There are three ways of measuring the relative size of these private rewards: the ratio of the recovery to affected sales, the ratio of settlement to the overcharge, and by comparison to the government's fine (Table 20).

Table 20. The Size of Private Awards

Measure	Global	Regional
Median settlement/affected commerce ratio	18%	1.3%
Median settlement/overcharge ratio	76%	29%
Median settlement/median fine ratio	1.75	2.06

Source: Appendix Table 6; Tables A.2, A.6, A.8, and A.12

To summarize, the median settlement rate for the 17 private cases was 12% of affected sales, with the global types 1.5 times as high. The median settlement rate as a proportion of the overcharge was 29%, and the global cartel median was 1.6 times as high.. The median dollar settlement was about $92 million, but the median global-cartel suit settled for 1.75 times as much. Global cartels by every measure typically yielded settlements that were 50% to 75% higher than regional cartels. Although these settlements recovered higher proportions of affected

sales than typical domestic price-fixing cases a decade or two ago, the typical international-cartel settlement is tiny compared to the 300% of damages envisioned by the framers of the Sherman Act

There is little to be said about private cartel suits outside the United States. These types of suits are permitted in Canada, Mexico, Australia, and most EU member states, but are rare in practice (Connor 2001: 89, 529-530). These jurisdictions typically permit only single damages, have high burdens of proof, and have low chances of success for plaintiffs. Up to 2003, only one private international-cartel suit has been concluded outside the United States in plaintiffs' favor. Buyers of citric acid in Canada were awarded C$8 million, which is 2% of the amount received by buyers in the United States. Suits are proceeding for iron oxide, lysine and vitamins buyers in Canada and vitamins buyers in Australia. No other private anticartel suits have been reported by the world's press.

The absence of private suits outside of three countries has a negative effect on deterrence of global cartels, because only about one-fourth of the injuries caused by such cartels occurs in the United States, Canada, and Australia. Buyers in other parts of the world have no recourse for private compensation in their local court systems, but one possible remedy is to allow foreign buyers standing to sue for treble damages in U.S. courts (Adams and Bell 1999). Foreign buyers who purchase exports in the United States already have standing, but what of foreign buyers whose purchases take place completely off shore?

The Sherman Act refers only to business transactions that "affect" U.S. commerce. In the case of global cartels, unless the cartel is able to keep prices high in Europe or Asia, geographic arbitrage will inhibit the ability of the cartel to maintain high U.S. prices. Thus, the injuries to buyers in Europe and Asia are a necessary adjunct to the affects on U.S. buyers, which suggest that such non-U.S. buyers should have the right to seek redress in U.S. courts.

Concerns about foreign buyers overwhelming U.S. judicial resources led to the passage of the Foreign Trade Antitrust Improvements Act (FTAIA) in 1982 (Davis 2003). The FTAIA excludes Sherman Act suits on "wholly foreign" sales unless a "foreign cartel" has a direct, substantial, and reasonably foreseeable anticompetitive effect on U.S. consumers or producers. U.S. court decisions have resulted in a check-list of factors that make a cartel "foreign". In this paper, the term "global cartel" fits these factors. At least two U.S. court decisions in 2002 and 2003 decided that wholly foreign purchases of vitamins and fine art in auctions had the right to sue in the U.S. courts, so long as at least one domestic buyer had standing to file a Sherman Act claim.

Although the U.S. DOJ has taken the position that deterrence will be impaired because fewer parties will apply for leniency, it is equally clear that expanding the sales territories over which suits can be launched will increase deterrence. In short, the net effect of such suits is an empirical question that must weigh the balance of the two effects. Deterrence issues are discussed in the next section.

Summary

Global cartelists face investigations and possible fines in as many as ten national and supranational jurisdictions. Mexico, Brazil, Japan, South Korea, Australia, New Zealand, and a few other countries have active anticartel agencies. However, the three jurisdictions with heretofore the most consistent legal responses to global cartels are the United States, Canada, and the EU.

The fines imposed by the United States, Canada, and the EU are roughly proportional to the sizes of the affected markets' sales in the respective jurisdictions. In the 11 overlapping cases of global cartels available, government anticartel fines were highest in the United States, 28% lower in the EU, and about 6% of U.S. levels in Canada (Table 21). Even more impressive is the high degree to which fines were correlated in size between jurisdictions. The simple correlation between the U.S. and EC fines was +0.96, between the U.S. and Canada +0.96, and between the EC and Canada +0.99. Thus, corporate members of global cartels can use their fines imposed by the U.S. DOJ, usually the first to act, to predict with a high degree of certainty what their fines will be a year or two later in the EU and Canada.

Table 21. Five Global Cartels with Corporate Fines Imposed by U.S., EC, and Canada, 1996-2003.

Cartel	U.S.	EC	Canada
	Million U.S. dollars		
Lysine	92.5	97.9	11.5
Citric Acid	110.4	120.4	7.9
Vitamins	906.5	756.9	64.0
Sodium gluconate	32.5	51.2	1.6
Graphite electrodes	436.0E	172.0	15.5
Sorbates	132.0	--+	5.1
Nucleotides	9.0	21.1	--
Vitamin B3	29.7	--	2.5
Isostatic graphite	15.4	51.0	0.4+
Fine art auctions	52.9	20.1	--
Methyl glucamine	--	2.83	0.34
Total	1,816.9	1,308.3	108.8

Sources: Tables A.1-A.12.
+ = more fines likely pending
-- = as of 2003, zero fines by this jurisdiction
Note: These are the only global cases for which two or more jurisdictions had imposed fines by mid-2003.

Given the near absence of private antitrust litigation in Europe, the total liabilities of cartelists operating in Europe are overall quite a bit lower in practice than an otherwise identical violation punished under U.S. or Canadian laws.

Deterrence

The corporate fines and personal sanctions handed out to global price fixers since 1995 were beyond and above the worst nightmares of corporate defense lawyers might have had in the early 1990s. Corporate cartelists, when they are unmasked by antitrust investigators, are now routinely paying fines that exceed their monopoly profits earned in North America and in Western Europe. Indeed, in North America, when the private treble-damages suits by buyers or the state attorneys general are factored in, prosecuted price fixers are nowadays normally disgorging close to double their illegal "earnings" (Connor 2001:469-476). Nevertheless, serious doubts remain that even the heightened fine structures observed since 1995 are sufficient to prevent recidivism (repeat offenses of the same crime).

In this section, a theory of optimal deterrence will be developed for the case of global cartels. A formula is presented that takes into account the special characteristics of cartels that operate across jurisdictions with varying types of sanctions. The empirical data collected for this paper are used to operationalize the formula.

Theory

A rational policy with respect to the design of legal sanctions would admit to two principal objectives: deterrence and compensation of victims.[61] The EC's cartel decisions are explicit in mentioning deterrence as the main objective of its determination of fine levels; to the extent that these fines are used to defray the EU budget, European consumers are at least indirectly compensated.[62] In the United States, treble damages (i.e., settlements equal to three times the victims' economic losses) were explicitly instituted in the 1890 Sherman Act to compensate buyers from cartels as well as to deter firms from forming cartels *ex ante*. However, the advent in the 1990s of the double-the-harm standard for setting government fines has led some legal writers to criticize cartel sanctions as having reached *supradeterrent* levels (Easterbrook 1986, Kelley and Savyed 2000, Cohen and Scheffman 2000, and Kobayashi 2001).[63]

These criticisms confuse the *ex post* liabilities faced by discovered cartel members with the *ex ante* decision making process that deterrence-fines are supposed to affect. True, the *theoretical* maximum fines and private settlements faced by prosecuted cartelists have reached surprisingly high multiples of cartel overcharges in the U.S. legal system. A domestic cartel successfully prosecuted in the United States is liable to pay up to *double* the cartel's overcharge to the federal government and *triple* the overcharge to direct buyers who file civil suits. In addition, the cartel can be sued by the state attorneys general for another set of *treble* damages

[61] A third motivation is sometimes mentioned, viz., funding the costs of detection and prosecution. In U.S. law, these costs are borne by both the government and by plaintiffs' lawyers. To the extent that these costs are incurred by plaintiffs, they may be regarded as compensatory.

[62] In 2001, EU antitrust fines amounted to 2 percent of its annual budget.

[63] Supradeterrence is frequently alleged in the context of treble damages. However, some legal commentators have specifically cited the increased global cartel fines and penalties as excessive. Some also argue that the first U.S. sentencing guidelines caused a serious overdeterrence problem. For an economics-and-law model suggesting supradeterrence of government cartel fines, see Kobayashi (2001).

incurred by indirect buyers.[64] Thus, domestic cartels are obligated to pay as much as *eight* times their illegal monopoly profits if they are found guilty. Moreover, suppose the cartel is a global one with a typical one-third of its sales in the United States. Then, the U.S. DOJ has the option of calculating its fine on the basis of global overcharges (which are likely to be three times the domestic overcharges). In this case the federal fine could rise to *six* times a cartel's U.S. overcharges. It is the possibility of fines and settlements totaling *eight to twelve times* a cartel's U.S. monopoly profits that leads critics to make claims of overdeterrence.

However, deterrence effects of anticartel policies must be evaluated *ex ante*, that is, from the perspective of a company considering forming or joining a global price-fixing conspiracy. Such a company must evaluate the probable additional profits from the cartel relative to the *probable costs* associated with being discovered and prosecuted. The theory of optimal deterrence in public law enforcement is reviewed by Polinsky and Shavell (2000)[65]. In the version of the deterrence model presented below, I assume that only corporate costs and benefits drive cartel decisions. This assumption seems reasonable because the involvement of top officers in these cartels suggests no principal-agent problem. Moreover, in recent decades many companies linked managerial rewards closely to corporate financial performance. Many cartels had weak boards of directors, as their restructurings after price-fixing episodes demonstrate. Personal fines are very low in the United States, and practically nonexistent elsewhere. Prison sentences are difficult to monetize.[66]

The evidence is that potential conspirators are adept at calculating the annual profits from an effective cartel, though they might have uncertainty about the scheme's longevity.[67] As to the probability that a cartel will be discovered, most evidence seems to suggest a 10- to 20-percent chance (Bryant and Eckart 1991, Feinberg 1985, Connor 2001, Cohen and Scheffman 2000, Adams 2002, Werden and Simon 1987).[68] Levenstein and Suslow note that government anticartel actions accounted for only 10% of some of the best documented cartels operating in the interwar period (p.16). Moreover, even if cartelists are indicted by the U.S. DOJ, the chances of being convicted are less than 100 percent. The DOJ likes to boast that more than 80 percent

[64] These are called *parens patriae* actions. Indirect buyers include both corporate and consumer purchasers. In 2000, 45 states joined together to sue the six largest companies in the vitamins cartels. Indirect buyers may also sue in about 16 state courts. Pass-on by direct buyers is no defense for these actions.

[65] Polinsky and Shavell (2000) survey more than 200 academic papers. Most of their examples are drawn from individual criminal acts. The model presented immediately below has two features not mentioned in the survey: the probability of conviction after apprehension and consideration of violations that inherently involve multiple geographic jurisdictions with varying sanctions and multiple geographic harms caused.

[66] Focusing solely on corporate benefits and costs runs counter to repeated public statements of DOJ officials, who assert the primacy of prison sentences in deterrence of cartels (e.g., Pate 2003). If individual sentences are important, then the fines on companies for optimal deterrence will be lower. Ignoring individual fines and prison sentences is controversial. The standard optimal-deterrence approach recommends only personal fines (Shawell 2003). However, Werden and Simon (1997) offer strong views on the necessity of imprisonment for price fixers. They argue that imprisonment is even justified by the Beckerian theory of deterrence because the optimal fines for price fixing, using 1975-1980 data in 1981 dollars, are about $1 billion. When individuals are too poor to pay fines, Becker seems to favor imprisonment. They also argue that optimal deterrence theory is inappropriate for price fixing.

[67] Historically the average global cartel lasted about eight years, with a range of two to 18 years.

[68] The highest rate is suggested to be 0.33 by Cohen and Scheffman (2000). Polinsky and Shavell (2000) note that for some of the most common felonious property crimes (burglary, auto theft, and arson), U.S. arrest rates vary from 0.138 to 0.165, well within the range adopted here.

of its indictments end in guilty pleas, which is true because the *per se* evidence is so damning in most cases that defendants usually negotiate a guilty plea. On the other hand, when accused price fixers choose to litigate a criminal price-fixing case, the government wins their cases less than half the time. Thus, cartelists adept at covering up their clandestine meetings or able to afford the best legal defense teams might well judge their chances of conviction to be in the 50 to 75 percent range.[69]

The decision facing a firm trying to decide whether to form a cartel or join an existing cartel may be explained using a benefit-cost framework. Let E(B) be the expected financial benefits, that is, the net present value of the expected monopoly profits accruing to the firm from an effective cartel. Let E(C) be the expected monetary costs of forming or joining the cartel, where the managerial costs are assumed to be negligible. Then the firm will opt to enter a cartel agreement if

[1] $E(C) < E(B)$,

but will opt to stay out if the inequality sign in [1] is reversed. If $E(C) = E(B)$, then the costs are deemed privately optimal.

In the simplest version of this decision model, one used by Richard Posner (2001),

[2] $E(C) = p \cdot F$,

where p = the probability of antitrust-authority discovery and conviction and F is the fine imposed for the violation.[70] An optimal fine is $F = E(C)/p$.

A more complete version of this model is

[3] $E(C) = p \cdot c \cdot E(F)$,

where p is the probability of detection and c is the probability of conviction or settlement. E(F) depends on the culpability factors and the size of the affected sales or overcharge (a range known with near certainty from the U.S. Sentencing Guidelines) and the firm's timing in applying for leniency. E(F) could be zero if the firm is granted amnesty, but even then the expected private settlement costs, E(S), are not zero. Moreover, the firm may incur significant legal defense costs and related managerial time losses as well as post-indictment reputational costs, E(R). Thus, in the case of a domestic conspiracy,

[4] $E(C) = p_g \cdot c_g \cdot E(F) + p_p \cdot c_p \cdot E(S) + E(R)$,

[69] Connor (2001: 60-61, 68-69).

[70] Posner (2001: 47). This formulation assumes that the justice system is costless and errorless, that offenders and victims are risk-neutral, and that the conspiracy was condoned by the company's top managers.

where subscripts g and p refer to *government* and *private* legal actions. In the usual follow-on suit, $p_p = 1$ and c_p will be very high (close to 1), but in some cases where the government does not indict, p_p and c_p are low positive numbers, much closer to zero than to 1.

In the context of global cartels, the decision-making model has added geographical components:

[5] $$E(C) = p_{gu} \cdot c_{gu} \cdot E(F_u) + p_{pu} \cdot c_{pu} \cdot E(S_u) + p_{ge} \cdot c_{ge} \cdot E(F_e) + p_{ga} \cdot c_{ga} \cdot E(F_a) + E(R),$$

where u = U.S. and Canada, e = EU and a = Asia.[71] Because of the absence of effective private damages suits outside of North America, it is not necessary to include $E(S_e)$ or $E(S_a)$ (First 1995).

Several simplifications can be made to Equation [5]. Because most companies are listed on at most one stock exchange, E(R) refers to stock-price effects in the firm's home country. Unlisted cartel members suffer little E(R), and in my view the reputational effects for public companies, if any, are very small and seem to dissipate within five years or less (Alexander 1999).[72] Thus, from a long-run perspective, E(R) = 0, and because of weak enforcement in Asia, $E(F_a) = 0$ and [5] becomes

[6] $$E(C) = p_{gu} \cdot c_{gu} \cdot E(F_u) + p_{pu} \cdot c_{pu} \cdot E(S_u) + p_{ge} \cdot c_{ge} \cdot E(F_e).$$

An important step in this analysis is to convert the right side terms into functions of B. When that is done, the algebraic expression can be solved for E(C). It is true that most DOJ fines are based on "20% of sales" base fine together with culpability multipliers, but as Tables 13.1 to 13.3 of Connor (2001) show, the difference in dollar fines are small between that method and the double-harm approach. Therefore, the maximum U.S. corporate fine is double the cartel's U.S. overcharges.

Given the standards that have evolved for corporate sanctions for global cartels, E(C) can be converted to a function of the private financial "benefit" of price fixing, where B is the global overcharge paid by direct buyers during the conspiracy period. For simplicity, the overcharge rate is assumed to be equal in all regions of the world. For a convicted cartelist, the actual *maximum ex post* costs C of global collusion will be

[7] $$C = E(F_u) + E(S_u) + E(F_e).$$

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[71] Equation [5] ignores the possibility of government antitrust fines in Mexico, South America, Africa, and Europe outside the EU. These areas could be added if anticartel sanctions become more severe.

[72] Reputational effects may be nonlinearly related to the size of a fine, especially if the fine represented a new record amount. ADM's $100-million fine assessed in October 1996 certainly fits this description. It was only beginning in 2000 or 2001 that financial profiles of ADM or its top executives failed to include references to ADM's 1996 price-fixing convictions. Alexander's empirical study finds, for five publicized price-fixing convictions between 1984 and 1990, no reputational effects for the corporate defendants.

Now with the facts in this paper on the actual fines and settlements applied to global cartels since the late 1990s, one can calculate the three expected costs in [7] in terms of B, where the firm assumes the most pessimistic legal outcomes. Because this analysis is *ex post*, p = c = 1. The U.S. DOJ imposes the maximum double-the-overcharge (2B) fine on domestic sales with no leniency discounts, but the DOJ bases the fine on only the 25% of the typical cartel's U.S. affected sales. Then the CCB adds its 6% to the U.S. fines. Thus, $E(F_u)$ = (1.06)(.25)(2B) = 0.53B. Similarly, EC fines are 72% of the U.S. (recall Table 16). Therefore, (F_e) = (0.72)(0.53B) = 0.38B. If direct buyers in the U.S. and Canada won full treble damages and legal costs of 25%, then $E(S_u)$ = (0.25)(1.25)(3B) = 0.94B.

Substituting these conversions into equation [7], one obtains

[8] C = 0.53B + 0.38B + 0.94B = 1.85B.

On the basis of equation [8], a firm might expect to pay as much as 1.85 times its global monopoly profits in fines and settlements.[73] Because C>B, one might expect that cartels will be deterred.

In the case of a more appropriate *ex ante* analysis, F(C) will be considerably lower than 1.85B because p and c are less than unity. In this analysis it is appropriate to use a range of likely parameters rather than point estimates. As discussed above, a consensus estimate for p_{gu} is a value between 0.10 and 0.33, with the higher value due to the recent success of the leniency programs adopted by most antitrust agencies. Given the improved degree of international cooperation in anticartel enforcement, it is reasonable to assume $p_{gu} = p_{ge} = p_{ga}$. For conviction, the DOJ's conviction record suggests that $0.5 < c_{gu} < 0.9$ is a reasonable range, and because most U.S. treble-damages suits are follow-on actions, $c_{pu} = 1$ is not unreasonable. Actual fines paid in the United States and EU can be used to derive expected fines, and these can be converted to an overcharge basis (B).[74] DOJ practice suggests that for the *average* cartel participant F_u = 0.18B to 0.64B; in the EU, F_e = 0.2B to 0.7B. Ringleaders of cartels have paid relatively high U.S. fines per dollar of overcharge (.6B to .7B), and small followers low fines (.2B to .3B). In North America, private suits against global cartels have yielded settlements of from 1.0 to 2.0 overcharges. These parameters, when substituted into Equation [7], imply that *ex ante*:

[9] E(C) = 0.17B to 0.25B.

The range of expected antitrust costs using realistic, historical enforcement practices results in a range that is far below the theoretical maximum costs calculated in Equation [8]. Thus, highly cooperative follower-participants in global cartels can reasonably expect to incur fines and settlements far below their expected cartel profits. Even under the most optimistic assumptions about discovery, lenience, and prosecution rates, the average conspirator can

[73] In certain cases, the U.S. DOJ can calculate its *base* fines on a world-wide sales basis; as the typical global cartel makes one-fourth of its revenues in North America, assuming that overcharge rates are equal in all regions, E(Fu) = (1.06)(2B), then E(C) = 2.12B+ (1.06)(1.25)(3B) + 1.44B = 7.5B. In fact, the DOJ has never exercised this authority, though global sales have been used to adjust culpability factors (Kovacic 2002).

[74] U.S fine practices can be found in Tables 13.1 to 13.3 of Connor (2001), and for the EU Table 14.1 (*ibid.*) suggests that F_u = 0.35B to 0.74B. For the U.S., F_u was 0.33B for lysine, 0.30B to 0.64B for citric acid, and 0.18B to 0.44B for vitamins.

reasonably expect to make a profit on the typical global price-fixing scheme. Only ringleaders of cartels that resist cooperating with prosecutors risk financial costs in excess of their expected profits. One example is ADM's participation in the lysine cartel.[75]

Given the rational expectations about the certainty of punishment just mentioned, what is an appropriate level of financial sanctions to deter price fixing before it starts? At a minimum, to ensure absolute deterrence of a global cartel, total financial sanctions should be *four times* the expected global cartel profits (the overcharge); this level of sanctions would deter the "leaders" that initiate and provide most of the discipline for cartels. In the case of followers, deterrence would require penalties in all geographic regions to be equal to *eight times* overcharges.[76] These extraordinary multiples demonstrate that, from a purely benefit/cost approach, even the theoretical maximum U.S. legal sanctions of eight times U.S. overcharges is insufficient to deter recidivism in global cartels[77].

This study is hardly the first to conclude that current fine structures are suboptimal. Cohen (1989) studied corporate fines handed down in U.S. federal courts in the late 1980s. He concluded that the fines alone equaled only 33% of the harm caused by the companies[78].

Sanctions in the United States

Recidivism in global price fixing is depressingly common (Appendix table 5). In part, this may be caused by the highly diverse businesses found in most large multinational firms. Price fixing in the 1990s bears all the marks of contagion, between and *within* enterprises. For example, soon after Hoffman-La Roche and BASF implement price fixing in vitamins A & E, the positive financial results prompted them to form at least five more highly complex cartels in eight other vitamins industries a year later. Furthermore, Roche's success in vitamins instigated one top Roche executive to write a memorandum to the head of the company's citric acid marketing department encouraging him to form a citric acid cartel. Soon after ADM and Roche began fixing the price of citric acid in 1991, the ADM vice president in charge of citric acid taught ADM's head of the lysine department how to form and run the lysine cartel (Connor2001: 199). At least a dozen firms convicted of global price fixing in the 1990s have become repeat offenders.

Although the theoretical financial costs of price fixing may strike some as high, the actual amounts of the fines and private settlements are much lower than what is legally possible in cases settled before 1990. A wide gap between the maximum penalties prescribed by the law and the actual penalties imposed has persisted after 1995 in fines imposed on global price fixers.

In the three best documented prosecutions of global cartels, U.S. government corporate fines of $1,106 million were precedent-shattering. Yet they represented merely 10 to 79 percent

[75] See Connor (2001: Table 19.4). ADM probably profited from its role in the citric acid cartel.

[76] These estimates assume that a global cartel's U.S. profit comprise one-third of its total monopoly profits worldwide. Strictly national cartels would require seven- to 20-times penalties. These estimates ignore the legal fees paid by defendants. If legal fees are substantial, the required multiple to deter would be somewhat lower.

[77] It also shows that the full force of U.S. law is quite capable of deterring purely domestic cartels.

[78] His analysis predates the U.S. Sentencing Guidelines (USSG 1997) and ignores nonmonetary penalties, restitution, civil penalties, and tort suits.

of the maximum possible fines that could have been levied (Table 22). To place them further in perspective, these fines represented only 2.8 percent of global sales during the three conspiracy periods and only 12.6 percent of the cartel's illegal profits.[79] Individual fines and prison sentences were also far more lenient than the law permits. These fines and sentences averaged 3 to 7 percent of the maximum levels allowed. Moreover, less than one-fourth of the individual conspirators were sanctioned at all.

Table 22. Potential and Actual U.S. Government Sanctions Applied in Three Global Cartels.

Cartel	Corporate Fines[a]		Individual Sanctions					
	Maximum	Actual	Number[b]		Prison		Fines[c]	
			Max.	Actual	Max.	Actual	Max.	Actual
	$ million		*Number*		*Months*		*$ million*	
Lysine	225-559	92.5	40	7	1440	99	14.0	0.9
Citric acid	189-721	105.4	12	4	432	0	4.2	0.8
Vitamins	994-9850	908.5[d]	52	13	1872	22.5	18.2	0.9
Total	1408-11,130	1,106.4	104	24	3744	121.5	36.4	2.6

Sources: Connor (2001:Tables 13.1, 13.2, and 13.3).
[a] Based on either the usual 20-percent of U.S. affected sales with a culpability score of 9 and multipliers of 1.8 to 3.6 or twice the U.S. overcharge. In general, had global sales been the basis of the fines, the maximum amounts shown in this table would be trebled.
[b] Named conspirators in the DOJ's proffers to the courts.
[c] Based on the $350,000 statutory cap, not on the much higher amounts allowed by the alternative sentencing statute.
[d] A few small companies have yet to plead guilty.

The major reason for the relatively low government fines is the ancient practice of prosecutors everywhere of offering rewards for a defendant's cooperation. Such cooperation may be needed to induce price fixers to testify against other, more recalcitrant co-conspirators; it may be given to low-ranking employees in order to prosecute high-ranking executives with greater deterrence value; or it may be justified as a method to conserve constrained prosecutorial resources. What is new is the promulgation of formal leniency programs in the 1990s by the U.S. DOJ and the EC's DG-IV for price fixing.

Here is how the U.S. Leniency Program works.[80] If a cartel member is not a ringleader or enforcer in the conspiracy and if the DOJ is not aware of the illegal activity, then the *first* firm to confess is granted automatic amnesty. Amnestied firms receive a 100-percent discount on its fine specified by the U.S. Sentencing Guidelines, and its officers receive immunity from prosecution. In the view of the DOJ, amnesty is valuable because it sets up a "race" to be first to confess and leads to tension and mistrust among cartel members (Spratling 2001). In game-theory terms, prosecutors are exploiting the "Prisoners' Dilemma".

An extension of this program called "Amnesty Plus" offers amnesty to suspected price fixers if they are the first provide evidence of cartel activity in an unrelated market about which the DOJ was ignorant. The many vitamins cartels were unmasked by this type of amnesty

[79] As a proportion of *U.S.* sales and estimated overcharges, the respective percentages are 14.0 of sales and 60 to 74 of overcharges. See Connor (2001: Table 19.5).
[80] Perhaps the most detailed description of the program is to be found in Spratling (2001).

granted to BASF. Indeed, as of 2001, more than half of the 30 grand juries established to investigate alleged cartel activity were set up as a result of the Amnesty-Plus Program.

The Leniency Program also extends concessions to later arrivals on the doorstep of the Justice Department. The *second* member of a cartel to offer its cooperation to prosecutors is entitled to a 50- to 80-percent fine reduction. The *third* and *fourth* conspirators to arrive may expect less generous discounts, but in effect all cooperators save the last firm to hold out are rewarded with substantial discounts. If anything, these leniency discounts, which were approved by a court, are larger than the official policy suggests. While the first and second firms to plea follow the Leniency Program standards, those that plea later receive discounts that exceed the program's stated guidelines. Similar incentives to cooperate are offered to individual conspirators: reduced fines, short prison sentences, or the freedom to cross the U.S. border.[81]

An example of how a company will fare if it is the last to be sentenced and does not cooperate is provided by the Mitsubishi conviction at trial in February 2001. For its indirect role of aiding and abetting price fixing in the graphite-electrodes cartel, it received a fine of $134 million. What is impressive is that the fine was 76 percent of affected U.S. sales, probably a record percentage, and very nearly at the top of the Sentencing Guidelines range; it was also *7.6 times* the assumed overcharge.

The U.S. Leniency Program for price fixing has been widely imitated by antitrust authorities in other jurisdictions. The most important adoption was by the European Union in February 2002.[82] Its new program makes the process for applying for full immunity far more transparent and predictable. Amnesty is *automatic* for the first company to reveal a cartel if (1) the EC was unaware of the cartel already, (2) cooperation is fully satisfactory, (3) the company immediately ceases price fixing, and (4) the company never coerced other companies to join to cartel. Thus, the new EC policy sets up strong incentives in the "races to be first" (to confess) to Brussels. Moreover, this race complements the race to be first to Washington, DC, Toronto, London, Paris, Brasilia, and at least three other national capitals where a company can earn multiple prizes. The global convergence of antitrust leniency policies has now become the major single source of information of formerly clandestine illegal activities that were nearly impossible to detect.[83] To a large extent, the potentially huge and automatic financial rewards for informing antitrust authorities have made the disease of global price fixing self-medicating.

Finally, to get a complete picture of the actual U.S. financial sanctions for collusion, one must consider the treble-damages suits filed by injured parties. In the three best-documented global cartel cases, private plaintiffs garnered record-making settlements totaling between $1,745 and $2,445 million (Table 23). However, compared to fairly reliable estimates of what U.S.

[81] As a general rule, convicted felons may not be issued passports or obtain visas to enter U.S. territories. However, by arrangement with the U.S. State Department, the Antitrust Division may obtain an exemption for some convicted price fixers. This concession has proven to be a valuable incentive to induce cooperation by middle-aged non-U.S. residents.

[82] The 2002 EC Notice replaced a 1996 leniency program that was not working very well because it retained too much discretion for EC officials and did not guarantee amnesty for the first applicants. Indeed, the EC did not grant any company amnesty until November 2001 when the vitamins cartels were fined. Hammond *supra* note 9.

[83] Grinberg (2003) considers the Brazilian leniency program a failure because the approval of rival enforcement programs is needed, and it is not automatic.

treble overcharges were, these settlements are well below what the Sherman Act promises to direct buyers. Lysine buyers received 35 percent of treble damages, citric acid buyers 32 to 40 percent, and vitamins buyers 32 to 54 percent. That is, injured parties got *single* damages (or slightly higher), not treble damages.[84] There is some evidence that the largest direct buyers that opted out of the federal classes obtained settlements that were twice as rich.

Table 23. Potential and Actual U.S. Private Settlements Paid by Three Global Cartels.

Cartel	Corporate Settlement Amounts	
	Treble U.S. Damages	Actual Settlements [a]
	Million dollars	
Lysine	240	85
Citric acid	600-750	239
Vitamins	3,660-4,515	1,421-2,121[b]
Total	4,500-5,505	1,745-2,445

Sources: Connor (2001:Table 16.A.1).
[a] These amounts include federal suits by direct purchasers (both class actions and firms that opted out of the classes), a *parens patriae* settlement in vitamins, and estimates of indirect-purchaser suits in state courts. The latter amounts may be generous.
[b] Several cases still in negotiation or litigation.

To summarize, government and private antitrust penalties on the lysine, citric acid, and vitamins cartels amounted to between $2,850 million and $3,550 million. Although by historical standards these amounts were great accomplishments for public prosecutors and private plaintiffs, they fall far short of what the Sherman Act intended. These price-fixing penalties amounted to about 47 percent of affected U.S. sales, or somewhere between 179 percent and 194 percent of the cartels' illegal profits. Although these sanctions have or will deter some cartels (relative deterrence), less than double overcharges will not deter absolutely.

Sanctions in Canada and the EU

The enhanced fines on global conspirators imposed by the governments of Canada and the EU help deter, but their incremental influence is still not sufficient to prevent the formation of new cartels.

In 1998-2000, the Canadian Competition Bureau (CCB) obtained court orders requiring the lysine, citric acid, and vitamins cartelists to pay a total of C$145.7 million. In addition, class-action suits were filed by direct and indirect buyers; two of these private damages actions were moderately successful. Taken together, the members of the three cartels have paid about U.S. $100 million in fines and settlements to parties in Canada.

In 2000-2001, the same three cartels were fined U.S. $975 million by the European Commission. Although legal in the courts of some of the member states of the EU, no significant private antitrust settlements are expected. The Australian, Mexican, and Brazilian

[84] As a percentage of U.S. sales (equals U.S. purchase values), lysine buyers obtained 18.5 percent, citric acid buyers 16.4 percent, and vitamins buyers 23.7 to 42.4 percent. The average was 32.6 percent. (Compare footnote 26 above).

antitrust agencies have launched investigations of the three cartels, but except for small fines for vitamins in Australia, none has yet resulted in significant fines.

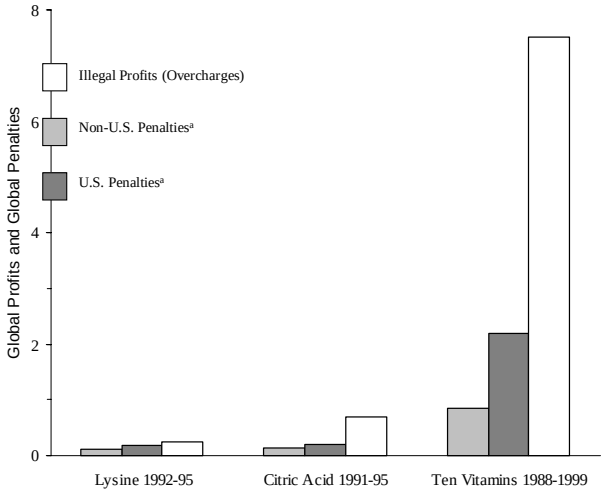
The ability of direct buyers who purchase cartelized products outside the United States to obtain compensation is quite limited. Canada, Australia, and several European countries have laws that permit private suits for injuries due to price-fixing overcharges, but mostly these national courts do not award sufficiently large to make such suits worthwhile. Moreover, the possibility of class actions to recover damages is low. However, class actions against the lysine and citric acid cartels have been moderately successful in Canada under a 1992 law. Moreover, a March 2002 decision by the U.S. Court of Appeals for the 2nd Circuit (*Kruman v. Christie's International*) has extended the rights of foreign buyers to sue for damages under the U.S. Sherman Act. Oddly, instead of U.S. legal standards spreading to other nations, the U.S. court system itself is becoming a globalized legal institution.

The additional $1.1 billion in non-U.S. fines for price fixing in the markets for lysine, citric acid, and vitamins certainly moves global anticartel policies in the right direction. Nevertheless, the global penalties imposed on the three cartels ($3,950 to $4,650 million) still represent modest amounts when compared to either worldwide affected sales (9.9 to 11.7 percent) or to worldwide overcharges by the cartels (51 to 60 percent).

The relationship of global public and private penalties to the cartels' illegal gains is illustrated in Figure 11. Estimated worldwide profits made from collusion are compared to U.S. and non-U.S. penalties for the three cartels. In each case, U.S. penalties are about double the non-U.S. (mainly EU and Canada) penalties. These penalties slightly exceed the cartel's monopoly profits only in the case of lysine, by about $40 million. However, in the other two cases, cartel crime did pay. The corporate members of the citric acid cartel made a net return of about $370 million; that is, they retained about 53 percent of their illegal profits after paying their fines and private settlements. The members of the vitamins cartels kept more than $4 billion of their illegal profits, or almost 60 percent of their customers' overcharges.[85] For ADM, probably the most heavily fined conspirator relative to its size, the antitrust costs of its lysine and citric acid ventures were about equal to its illegal net revenues.

[85] Recall that this is an *ex post* analysis. Viewed from the dates of cartel formation (1988-1992), the *expected* profit-retention rate would have been well above 90 percent.

Figure 11: The Bottom Line: Does Cartel Crime Pay?



Source: Tables 3 and A.3, Connor (2001)

Effectiveness of Anticartel Sanctions

The data collected on international cartels for this paper suggest four indicators of enforcement effectiveness by antitrust authorities. First, the speed with which the agencies investigate, negotiate, and impose sanctions may be analyzed. Generally, long delays in the administration of justice are regarded as bad public policy. One can imagine an investigation that is too short for an adequate judgment about probable cause, but the main complaint of defendants is about excessive length and the consequent period of uncertainty of prosecution or the size of sanctions, especially if the investigation becomes public, as many do. Plaintiffs especially have an interest in quick conclusions to suits, which defendants habitually delay as far as possible (Adams and Metlin 2002). A peculiar feature of international cartels is that when a probe, fine, or guilty plea is made in one jurisdiction, it may well trigger follow-on investigations in other jurisdictions. Although court trials are rare for either criminal or civil prosecutions, they can add several years to a final determination of guilt; in the EC, appeals about the sizes of the EC cartel fines are common, but as these are by choice of the fined companies, this aspect of speed will not be studied.

A second indicator is the pattern of cartel formation over time. The simple notion underlying this measure of enforcement effectiveness is that as information becomes available to business persons about increases in maximum legal price-fixing penalties, in the probability of detection, or in harshness of actual sanctions corporate decision makers will raise their expectations concerning the costs of illegal behavior. This information is likely to arise from several sources: legal advisors, business and trade publications, and the informal exchange of

information between business persons. The lags in learning and in forming convictions may be considerable. Therefore, conclusions about the relationships between milestones in anticartel laws or enforcement actions and decreases in cartel formations will require long periods of analysis.

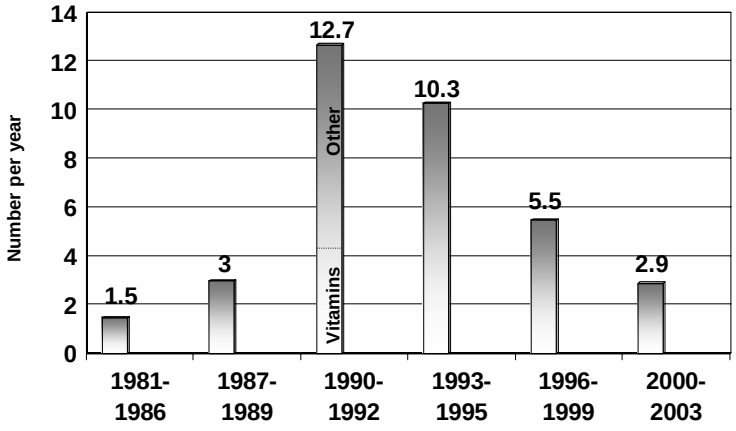
A third measure of effectiveness is the size of a company's fine relative to its sales during the cartel period; alternatively, the fines on all members of a cartel can be compared to total market affected sales. Although these ratios have no direct relationship to economic deterrence, they are the most frequently cited measure of a successful prosecution in legal discussions. Judicial opinions on the fairness of proposed class-action settlements inevitably focus on the recovery/sales ratio proposed relative to the same rations from other settlements. Class counsel likewise highlights this ratio when defending a settlement from criticisms about a particular deal. Recoveries above 10% or even 5% of sales are cited as successful results for plaintiffs. Some students of cartels opine that fines as high as 150% of affected sales are necessary for absolute deterrence (Wils 2001). Despite the absence of a firm economic defense for the fine/sales ratio (fines relative to profits or liquid assets might be more defensible), this index reveals something about the rigorousness of anticartel enforcement over time or across jurisdictions.

The fourth measure of enforcement effectiveness is the ratio of monetary sanctions to the cartels overcharge. This index bears directly on the question of economic deterrence. Unfortunately, it is the most difficult to compute and the most likely to contain measurement errors.

Rates of Cartel Formation

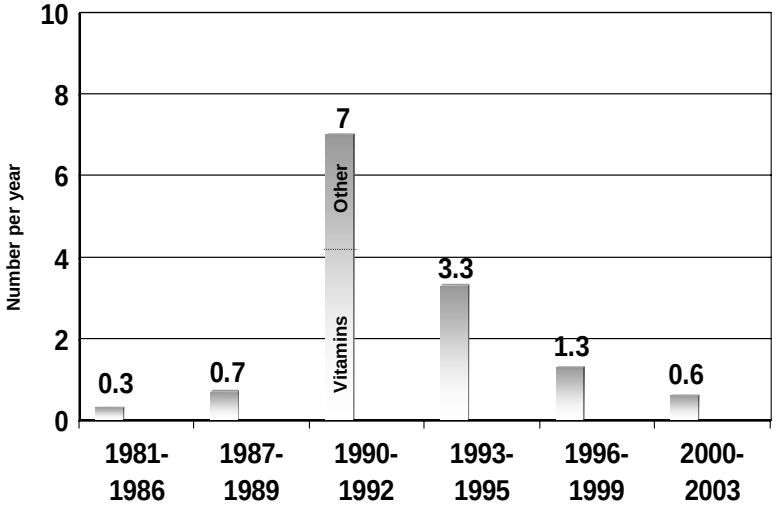
At this time only an informal analysis of cartel formation is possible, based on the patterns shown in Figures 12 to 15. In every geographic region, the annual rates of cartel formation (the year the cartel began fixing prices) peaks in the early 1990s. The increase in formation rates from the 1980s to the 1990s is particularly striking and informative. The acceleration in new cartels is apparent for all types of international cartels, global, European, and North America.

Figure 12. Rates of Formation: All International Cartels



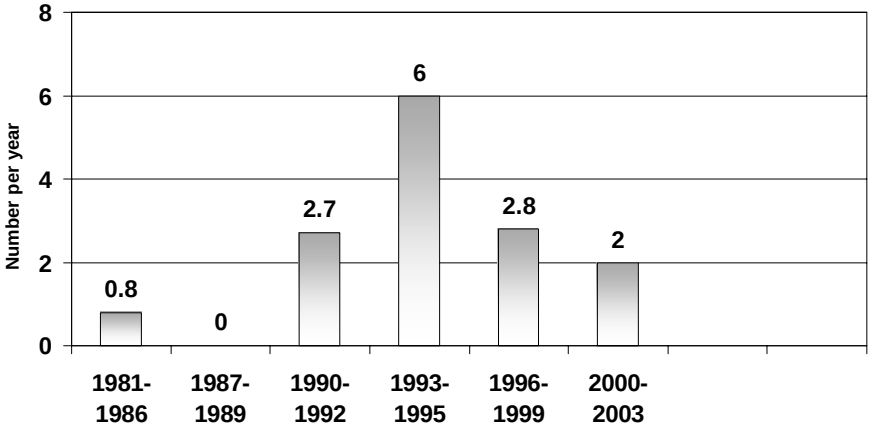
Source: Table 4A. Dates are years of initial operation; planning and initial agreements may have occurred up to one year earlier.

Figure 13. Rates of Formation: Global Cartels



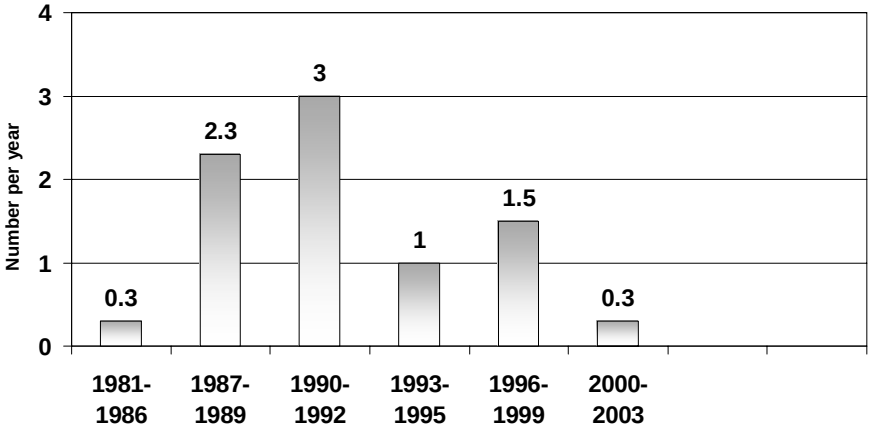
Source: Table 4A.

Figure 14. Rates of Formation: European Cartels



Source: Table 4A.

Figure 15. Rates of Formation: NAFTA Area Cartels



Source: Table 4A.

The NAFA-area cartels began at a slightly earlier time than the other two types (cf., Figure 15 and Figures 13 and 14). During the 1981-1988 Regan administration, the resources of the U.S. DOJ were directed primarily at small scale bid-rigging conspiracies (Connor 2001: 67). Attention to international cartel enforcement rose slightly during the Bush *pere* administration, but really became a major priority of the DOJ only after 1992. U.S. legal sanctions increased in 1987 when price fixing was made a felony and in 1990 when the statutory corporate fine was

raised to $10 million; however, the DOJ seems not to have implemented these new powers until the 1993-1994 period (Spratling 1999, 2001). The fall-off on new cartel formations in North America is consistent with the threat of the DOJ's enhanced prosecutorial powers and, after the DOJ's singular victories in the lysine and citric acid cases in 1995-1996, with the demonstrated ability to win in court. The notable decline in new cartel formations after 1992 is suggestive of a deterrence effect, but only a longer time period will allow for a more definitive conclusion.[86]

Europe began successful prosecution of international cartels in 1969, but significantly increased the priority to investigate such cases only from the mid 1990s.[87] Figure 14 demonstrates a peak in cartel formation in 1993-1995 and a notable decline after 1995. Again, although time will tell if the post-1995 decline is not just a statistical illusion, the pattern is consistent with increased cartel deterrence after 1995.

Finally, global-cartel initiations also peaked in 1989-1992; those formed prior to 1989 are mostly shipping conferences, which operated in a grey area of the law. Though too early to tell, the successful prosecutions of several high-profile global cartels in the late 1990s may well have had a chilling effect on would-be global cartelists.

Speed of Sanctions

Table 24 summarizes the information available on time lags in enforcement actions with respect to international cartels prosecuted from 1990 to 2003. The first panel in the table calculates the percentage of cases for which there were no lags between the first public notice and the announcement of the sanction by the antitrust authority (guilty plea, indictment, fine, or consent decree). In other words, these percentages are indicators of how well investigations are kept secret. In the United States, grand jury proceedings are secret, but their existence may become known if someone asked to testify voluntarily reveals it.

Data on lags are available on 106 cartel cases. On average, half of the cases were kept secret until the day sanctions were announced, but secrecy was far more pronounced in North America than in Europe. The U.S. grand jury system is clearly effective in most cases, whereas the use of "dawn raids" in Europe makes most investigations public at an early stage of investigation. Over time it appears that the secrecy of EC cartel investigations is increasing. In fact in 2000-2003, secrecy levels of the EC were at levels comparable to U.S. and Canadian practice. European national agencies are even more transparent than the EC.

Looking only at cases with positive lags (about 58 observations), the average time between "first notice" (generally news accounts of raids) and the first cartelist to be sanctioned is 18 months. However, the raid-to-sanction lag is far shorter in the United States than for EC cases: 7 months versus 35 on average. The DOJ dispatches more localized cartels with amazing alacrity (three months) compared with more complex and challenging global-cartel cases (16 months, four times as long). Rather surprising is the relative speed of the European national

[86] As discussed above in the context of Table 4A, the fact that no data are collected after 2003 puts a ceiling on formations, which tend to lead discoveries by about six years.

[87] Competition Commissioner van Miert reorganized DG-4 at that time; Commissioner Monti dates the resurgence in anticartel enforcement from 1998. The member states began separate enforcement about 1997.

antitrust authorities (eight months), which may be related to the smaller size of the cartels prosecuted, greater prosecutorial resources, or the familiarity of agencies' staffs with local markets. Time series data are fairly thin, but there is some evidence that the EC is moving its cases through more rapidly in the 2000s than in the 1990s. Note that these figures include only the most active phase of cartel investigations. Prior to obtaining search warrants, an antitrust authority may spend two or three years determining probable cause (as in lysine and vitamins), though a few months is probably more typical.

The final analysis of speed concerns lags between jurisdictions in the case of overlapping prosecutions. In the lysine case, the DOJ began its undercover investigation in November 1992, raided corporate headquarters in June 1995, and negotiated the first guilty pleas in September 1996, EC fines came more than five years later. Are such long leader-follower lags typical?

Table 24 shows that the lysine case was atypically long. On average, the lag from the date an investigation or guilty plea is publicly known in the United States to the date a cartel fine is imposed by the EC is 34 months. This is a minimum figure, because under cooperative arrangements in force since the 1990s, the EC is informed in advance about U.S. programs in investigations on many cases; the average length of advance notification is unknown. Canada, on the other hand, responds far more quickly to the news of U.S. guilty pleas or indictments. The CCB has had longer and more complete working arrangements with the U.S. DOJ, has had a corporate leniency program in place long before the EC, and unlike the EC does its work without protracted multi-stage administrative hearings.

Finally, Table 24 shows that the U.S. DOJ is typically the first mover in global cartel cases. In 15 instances, U.S. action predated EC action; in 14 cases, Canadian prosecution predated EC fines. In only two cases has the EC completed its work in advance of one of the North American authorities.

Monetary Sanctions Relative to Sales

The ratio of fines for international price fixing to cartels' affected sales is computed for a large sub-sample of prosecuted cartels (Table 25). In some cases, affected sales are known only for one or two jurisdictions but are unavailable for other parts of the world; these observations are reported under the appropriate jurisdiction. However, if a reasonably accurate sales figure cannot be found for a region in which a global cartel was known to operate, the "global total" cannot be computed; likewise in a few cases global sales are known but not regional affected sales. Affected sales are sometimes only available as a range. The total number of observations is close to 100.

Table 24. Time Lags, International Anticartel Enforcement, 1990-2003.

Cartel Types	No Lags [a]					From First Notice to First Sanction [b]					Sanctions From Jurisdiction to Jurisdiction			
	US	Can.	EC	Other Europe	Total	US	Can.	EC	Other Europe	Total	U.S. to Can.	U.S. to EC	Can. to EC	EU to Others
	Percent					*Months*					*Months*		*No. of Cases*	
Global scope	41^{32}	100^{1}	25^{12}	--	52^{45}	16^{7}	--	29^{8}	--	23^{15}	7.3^{16}	34.0^{15}	14	2
NAFTA area	76^{25}	67^{3}	--	--	75^{28}	3^{14}	15^{1}	--	--	4^{15}	11.0^{3}	--	--	--
EU Regional	--	--	33^{21}	--	33^{21}	--	--	39^{1}_{4}	--	39^{14}	--	--	--	--
European nations	--	--	--	8^{12}	8^{12}	--	--	--	8^{14}	8^{14}	--	--	--	--
Total	61^{57}	75^{4}	30^{33}	8^{12}	49^{106}	7^{12}	15^{1}	35^{2}_{2}	8^{14}	18^{58}	7.9^{19}	34.0^{15}	14	2
Food & agricultural products	85^{20}	100^{4}	11^{9}	50^{2}	66^{35}	8^{3}	--	34^{8}	8^{2}	24^{13}	9.2^{14}	32.3^{11}	10	2
Other products & services	74^{23}	0^{1}	36^{22}	15^{13}	46^{59}	17^{7}	15^{1}	36^{1}_{4}	11^{10}	23^{32}	5.3^{3}	23.0^{3}	2	0
Date of First Notice:														
1990-1995	57^{7}	67^{3}	0^{9}	--	31^{19}	15^{3}	15^{1}	43^{9}	--	34^{13}				
1996-1999	79^{19}	100^{2}	8^{10}	--	57^{31}	16^{6}	--	31^{1}_{1}	--	26^{17}				
2000-2003	75^{16}	--	67^{4}	14^{14}	49^{34}	18^{5}	--	3^{1}	11^{12}	13^{18}				

a) A measure of secrecy maintained by the antitrust agencies and the targets of their investigations. Superscripts are number of cases.

b) Measures the time between a raid that is reported publicly and the date the first corporate participant is fined. Cases of no lags are not calculated in these columns.

Source: Appendix Table 3

On average, the U.S. DOJ and CCB have imposed corporate fines equal to 14% to 17% of cartelized sales. This represents a significant increase since the late 1970s, when the average U.S. fine was 1.4% of sales (Cohen and Scheffmann 1989). The EC and other national agencies (overwhelmingly located within the EC) assess fines of 9% to 10% of affected sales.[88] In North America, private treble-damage suits (and, where known, other private antitrust suits) have won settlements that average 9% of affected commerce. Thus, in the United States (and two or three cases in Canada), public fines and private recovery have amounted to 23% to 26% of sales – more than double the European rates. Global cartels that were sanctioned in both North America and Europe have on average paid 34% to 37% of their cartels' sales in fines and settlements.

However, the *mean* percentages shown in Table 25 probably distort what is typical because the sanction/sales ratios are highly skewed. The calculated means are the compound result of a small number of very high ratios and large number ratios close to zero. In such cases, the *median* sanction is a better indicator of central tendency.[89]

Median fines are lower than mean fines in every jurisdiction. In North America, median government cartel fines are 9% to 10% of affected commerce. The EC's fines are not quite as skewed, so the median fine is just two percentage points lower than the mean (8% versus 10%). The other fines of the other national antitrust authorities are highly skewed, the median (3%) being one-third of the mean. The most extraordinary finding is that the median *private* settlement is zero, an outcome predicated by the fact that victims of cartels located outside North America have no recourse to civil damage suits. Where permitted, civil suits are settled for 6% to 12% of sales. Therefore, as a percentage of total sales (in all areas affected by the cartel), the typical corporate sanctions amount to a mere 4% of the cartel's revenues.

There is some variation in sanction rates by product and geographic types. Median sanction rates are significantly higher for the regional food-and-agricultural cartels (most of them organic-chemical intermediates) than for other products; the ratio is roughly three to one. However, this food/nonfood difference does not apply to global-scope cartels. Global cartels prosecuted by the U.S. DOJ suffered fines that averaged 18% to 23% of affected sales (with nonfood the higher figure); in Canada and Europe, global cartelists can expect fines to average 8% to 16% of revenues (with food the higher ratio). Because *global* cartels always fixed prices in both Europe and North America, the typical government fines to be expected will amount to 32% to 35% of sales, depending on product type. *Regional* cartels are on average treated far more leniently by antitrust agencies: EU-wide cartels typically are fined by the EC around 2% to 3% of sales; single-country cartels are normally fined from 3% to 4% of their regional sales.[90]

To summarize, multi-continental cartels have experienced markedly higher sanctions relative to affected sales than more localized international cartels. Government authorities imposed historically median fines of 32% to 35% of affected commerce on global cartels; many of them also had civil settlements averaging 6% to 12%, depending on products sold. However,

[88] This figure is within the range of 2% to 15% suggested as the typical EC practice in the 1990s (Wils 2001).
[89] In addition, while data on government fines is always public, smaller private settlements are often unreported (because they are deemed not newsworthy), or news of them is delayed.
[90] Canada's CCB seems to be much higher, 8% to 19%, but this result is driven by a few bid-rigging cases where the government was the victim. This issue is discussed below.

international cartels operating in only one country or within the EU faced distinctly more lenient treatment: government fines of 1% to 4% of sales, and no additional civil liability for cartels outside North America.

The data on private settlements for regional NAFTA cartels are sparse but suggest settlement rates average 1% to 6% of sales.

Sanctions Relative to Injury

Injury is measured by the average monopoly overcharge achieved by a cartel during the entire conspiracy period.[91] These figures fall in a range of degree of precision and are in many cases expressed as fairly wide ranges. About 70 estimates are available (Table 25); for some global cartels separate estimates are available for two or more of the continents on which they fixed prices. One or more geographic estimates are available for 54 distinct cartel cases. As before, *median* measures of the sanction/overcharge are preferred to the mean because of evident skewness in these ratios.

The median total sanction (government and private) on all types of international cartels is 25% of the estimated overcharge (Table 25). For all product types, there is practically no variation in the severity of government fines across jurisdictions; moreover, in North America the private settlements appear to gravitate near the 25% level, but the size of the sub-sample is perilously small to be confident about this result.

Once again, these data point to significantly higher sanction/injury ratios for global cartels than more geographically localized cartels. However, before examining the severity of sanctions across types of cartels, an issue must be addressed. It is clear that governments treat bid-rigging against themselves with greater than average severity. Therefore, Table 26 separates these cases from those cartels that sold principally to private buyers. Although there are only 8 such observations, sanctions averaged more that *five times* the overcharges imposed by bid-rigging against government agencies.

Cartels directed at private buyers still evidenced fairly high mean ratios. Government fines averaged from 43% to 66% of overcharges; in North America, cartelists settled for about 72% of calculated damages.

[91] The dead-weight or "social" loss due to price fixing would lower these ratios by at least 10% on average.

Table 25. Cartel Affected Sales and Sanctions, 1990-2003

Cartel Types	Mean (Median) Overcharges					Public & Private Sanctions					
	U.S.	Canada	EU	Other Areas	World	U.S. DOJ	CCB	EC	Other Gov't[b]	Pvt.	Total
	Percentage of Affected Commerce										
Food & ag. products:											
Global coverage	24-25[15] (25)	26-34[3] (22-32)	31-34[2] (31-34)	8[1] (8)	25[14] (27)	15[7] (18)	11[6] (12)	12[12] (16)	0[5] (0)	12-14[7] (12)	14[5] (12)
EU-wide	--	--	30[2]	--	30[2]	--	1.5[1]	2.9[2]	--	0[3]	2.9[2]
Other regional	9.5[2] (9.5)	6.4[2] (6.4)	--	--	9.8[3] (10)	8[5] (4)	28[5] (19)	-- --	3.8[3] (4)	8.7[3] (1.4)	17.2[10] (10-13)
Nonfood products:											
Global coverage	43-74[4] (38-45)	25-48[3] (50-63)	48-73[4] (42-44)	54[1] (54)	49-82[3] (52)	20-35[4] (23)	13[3] (9)	8[5] (8)	54[1] (54)	71[2] (71)	17-18[5] (5)
EU-wide	--	--	39-100[2] (17)	--	39-100[2] (17)	--	--	8[13] (2)	--	0[13]	8[13] (2)
Other regional	20-25[6] (22-24)	16-25[2] (16-25)	37-38[13] (25)	15[3] (17)	29-31[23] (21-25)	12[9] (0.6)	8[2] (8)	4[2] (4)	10[23] (3)	9[3] (6)	10[30] (3.5)
All types	25-31[27] (25-26)	20-31[10] (25-35)	37-61[30] (26)	21[5] (23)	30-42[54] (25)	14-17[25] (9)	16[17] (10)	10[34] (8)	9[32] (3)	9[31] (0)	12[65] (4)

= Not available, probably not zero.
Source: Tables A.1 to A.12.
Note: superscripts count the number of observations.

a) The average of the ratios of the percentage sanction divided by the percentage overcharge, in those cases where both are available and both are non-zero. If either is a range, the midpoint of the range is used. The "private" column shows treble-damage suits.

b) Prosecutions by other national competition authorities include Italy (4.5%, average of 12 cases), the Netherlands (4.3%, 2 cases), Sweden (39%, 2 cases), Australia (2.3%, 1 case), France (0.1%, 1 case), Korea (27%, 1 case), Japan (1.25%, 1 case), and Germany (15.5%, 1 case).

Table 26. The Severity of Sanctions Relative to the Degree of Injury, International Cartels, 1990-2003

Type of Cartel	Government Bid-Rigging					Private Purchases					
	US	Canada	EC	Other Gov't.	World	US	Canada	EC	Other Gov't.	Private	Total
	Average Percent Sanctions ÷ Percent Overcharges [a]										
Product and region:											
Global food & ag.	--	--	--	--	--	66[4]	53[3]	58[2]	--	72[5]	52[4]
EU-wide food & ag.	--	--	--	--	--	--	--	8[1]	--	0	8[1]
Other food & ag.	--	4,176[1]	--	--	4,176[1]	6[2]	36[1]	--	--	130[2]	122[2]
Global non-food	--	--	--	--	--	29[2]	27[2]	9[2]	100[1]	67[2]	38[2]
EU-wide non-food	--	--	141[1]	--	100[1]	--	--	71[7]	--	0	61[7]
Other non-food	142[1]	--	--	62[5]	119[6]	43[5]	73[2]	44[1]	59[5]	45[4]	54[12]
All types	142[1]	4,176[1]	141[1]	62[5]	549[8]	43[13]	50[8]	53[13]	66[6]	72[13]	55[29]
Prosecuted before 2000	--	4,176[1]	141[1]	7[3]	864[5]	45[12]	51[7]	46[8]	92[2]	60[7]	53[22]
Prosecuted since 1999	142[1]	--	--	152[2]	149[3]	13[1]	39[1]	56[5]	52[4]	86[6]	58[7]
	Percent										
Less than 10%	0	0	0	40[2]	25[2]	21	11	43	27	8	30
10-49%	0	0	0	20[1]	13[1]	36	56	21	27	31	30
50-99%	0	0	0	0	0	21	11	14	18	23	5
100-199%	100[1]	0	100[1]	100[2]	50[4]	21	11	21	36	23	22
200% or more	0	100[1]	0	0	13[1]	0	11	7	0	8	11

Source: Appendix Table 6

a) Based on 61 observations, 12 U.S., 8 Canadian, 14 EC, 11 other governments, and 12 private suits. "Total" column included only if all affected regions' data known.

Thus, a typical international cartel that fixed prices only in Europe paid in fines roughly 53% to 66% of its monopoly profits – less than single damages. However, from the bottom of Table 22, it appears that about one-fourth of these European-only cartels did forego 100% or more of their monopoly profits; the great majority experienced fines that were less than half their illegal earnings.

The case of cartels prosecuted in North America is more complicated. The geographically localized cartels could expect mean fines of about 30% of their U.S. overcharges or about 60% of their Canadian overcharges; most were subsequently sued for private damages and settled for an additional 50% to 60% of their overcharges. Thus, total sanctions for localized North American cartels is somewhere around 80% to 120% of overcharges – significantly higher than comparable European cartels but well below the twelve-fold damages possible under U.S. antitrust law.

In the case of global cartels, one might expect more severe sanctions than those imposed on regional cartels. Typically, global cartels are fined in these jurisdictions and are sued for treble damages in the U.S. courts. On average, global cartels were meted out fines that were roughly 40%, 43%, and 35% of their U.S., Canadian, and EU overcharges, respectively. Weighted by the value of these overcharges, the sum paid in fines was roughly 38%. Private settlements extracted on average an additional 70% of U.S. overcharges. Thus, for a typical global cartel discovered since 1990, fines and settlements extracted roughly 110% of North American monopoly profits and 35% of its European profits. With affected sales roughly equal in these two continents, the weighted sanctions average less than single damages. Profits made elsewhere in the world are virtually free of potential sanctions.

Summary of Cartel Injuries

It is possible to project the amount of injuries sustained by direct buyers from the 167 international cartels in this paper's data set. Affected sales are known for the majority of these cartels, and overcharges for a large minority. Mean levels of each can be calculated by type of cartel and projected by the total number of cartels in each category (see Appendix Table 7 for details).

Direct buyers purchased about $620 billion of products and services from international cartels that were discovered from 1990 to 2003 (Table 27). This figure understates the total because the majority of such cartels are undiscovered and because no allowance is made for inflation. Nearly half of affected sales were generated by global cartels. One-sixth was sales to food and agricultural customers.

In light of these huge projected injuries, it is useful to summarize the aggregate costs to cartelists in the form of antitrust sanctions. Private and government penalties of $10.5 billion have been imposed on participants in about 120 different cartels (Table 28, eliminating double counting). In addition, 32 corporate executives have received prison sentences averaging 10 months. It is clear that the penalties melted out to international cartelists are a small share of the projected overcharges.

Table 27. Total Projected Injuries of International Cartels, 1900-2003

Type of Cartel	Affected Commerce	Direct Overcharges
	Million U.S. dollars	
Global food & agriculture	80,912	20,228
EU-wide food & agriculture	19,811	5,844
NAFTA food & agriculture	3,024	1,421
European food & agriculture	6,055	1,744
Global non-food	197,299	59,782
EU-wide non-food	124,455	24,891
NAFTA non-food	48,987	12,737
European non-food	53,757	9,838
Other national non-food	5,022	904
Total	539,322	137,388

Source: Appendix Table 7

a) Australia (two), Korea, Japan, and Chile.

b) Known amounts for each type plus the median amounts for the unknown observations.

Table 28. Summary of Sanctions Imposed on International Cartels, 1990-2003.

Jurisdiction [a]	No. of Cartels	No. of Participants	Fines and Civil Settlements [c]
			Million U.S. Dollars
United States:	37	200	5,299
Corporate	36	95	1,875
Individual	--	105 [b]	24
Private suits	17	--	3,400
European Union	35	259	3,649
Canada	17	68	133
Member State of EU [d]	40	400	1,246
Other nations	11	48	210
Total	140 [e]	975 [e]	10,537

-- = Not applicable

[a] Only in the United States are significant numbers of individuals fined; all others are corporate fines.

[b] Includes 43 indicted fugitives in U.S. individual line. U.S. imprisonment for 32 persons totaled 342 months.

[c] There are missing data for many U.S. civil suits and especially for state indirect-purchaser suits.

[d] Includes Norway, which for antitrust purposes is part of the European Economic Area.

[e] Includes double counting of about 19 cartels prosecuted in more than one jurisdiction. See Table 21.

Overcharges are projected to have been about $137 billion for all the cartel types, of which 58% was generated by global cartels, 22% by EU-wide cartels, and 10% by NAFTA area cartels.

Final Thoughts

After spending a possibly inordinate amount of time on the subject of global cartels, I still perceive a number of unanswered questions raised by the eruption of global cartels in the 1990s. Two seem paramount. What were the economic, financial, and political forces the facilitated the establishment of dozens of effective international cartels in the late 1980s and early 1990s? What remedies can be implemented to discourage and possibly deter the formation and reduce the effectiveness of global cartels?

Cartel Formation

The temptation for a company in an appropriately structured market to launch or join a cartel is well understood: it is a golden opportunity to increase profits to levels higher than those being earned, at present or in the foreseeable future. Were it not for the possibility of punishment under antitrust laws, cartels would run rampant, monopolizing vast stretches of national economies or international trade. We know this to be true because of numerous reliable economic studies of cartel activity during eras prior to the adoption of effective anticartel legislation. This was the state of affairs in the United States before the 1890 Sherman Act (Connor and Schiek 1997:37-42), in Germany before 1945 (Voight 1962), in the United Kingdom before 1956 (Symeonidis 2002), and in international trade before the U.S. prosecutions of the late 1940s (Stocking and Watkins 1946). In the UK in the early 1950s, hundreds of formal, open, and legal cartels operated in nearly half of the manufacturing sector, some of them of 70-years duration (Symeonidis 2002:21). Hundreds of international cartels operated in the interwar period, affecting nearly half of international merchandise trade (Stocking and Walkins 1946).

The temptation facing company managers to form or joining a cartel are more varied and complex. Loyalty to their employer and a desire to contribute to its financial performance often seem to play a role. At a more personal level, the desire for advancement and monetary rewards cannot be discounted. In the case of some managers in the lysine cartel, other personal motivations included the sheer thrill of controlling markets (akin to the mariner's dream of sailing against the wind) and the nervous pleasure derived from the cloak-and-dagger aspects of outwitting the authorities (Connor 2001:199-229).

International cartels were relatively few during 1950-1990, especially compared to the interwar period (Caves 1996). Among the economic conditions accounting for the paucity of cartels after 1950 were the emergence of more aggressive behaviors by the largest U.S. manufacturers (through foreign investment and acquisitions that broadened their product lines), the focus of most European firms on rebuilding their domestic market positions, and a shift away from homogenous products toward differentiated consumer of high-tech goods. Most of the global cartels discovered after 1995 were formed during a narrow period, 1998-1992. There are tantalizing hints that slowing profitability in the late 1980s may have stimulated many of the cartelists to consider more risky alternative strategies. In the organic chemicals industry, a pronounced cyclic slowdown was apparent in the late 1980s; several pharmaceutical companies had "blockbuster" products coming off patents at the time; and in starch manufacturing, the period of rapid growth in high fructose corn syrup ended abruptly in 1986-1987 (Connor 2001).

In Japan, the first troubling signs of the end of the "bubble economy" began to emerge in the late 1980s. By the early 1990s, massive corporate and government debt and falling asset prices had led to chronic recession, a weaker yen, and falling profits.

Changes in corporate management philosophies, especially evident in U.S. firms but also spreading to European companies, may have contributed to the acceptability of price-fixing. Criticism of top management of U.S. companies became intense during the decade of slow U.S. growth that began in 1973. A widespread solution during the 1980s was the implementation of new managerial reward structures that tied leaders' pay more closely to financial performance, often short run profits and stock price. Boards of directors approved generous stock-option plans and other compensation policies that made stockholders' interests the only stakeholders of importance. Restructuring corporate management to remove putatively unnecessary layers of management and other changes meant to enhance flexibility and speed of decision making came at the cost of cross-checks and accountability. Increasingly, corporate leaders were being trained in MBA programs with increasingly uniform curricular that emphasized applied management tools and had little room for courses on business ethics. Many critics of modern business principles decry what they perceive to be a decline in corporate ethics, extending to the consulting and accounting professions as well (Krugman 2002).

The third area that may have fostered cartel formations is that of politics and policy. The successful prosecution of scores of global cartels in the late 1940s is cited by Caves (1996) as one factor explaining the decline in cartel activity for 30 years or more thereafter. Perhaps these lessons were lost as successive generations of corporate leaders assumed the helms of their companies, or perhaps the lessons were not institutionalized through antitrust management-training programs or the monitoring efforts of corporate counsel. The enforcement of antitrust became more lax during the Reagan-Bush administrations (1981-1992) as the antitrust agencies' budgets were cut nearly in half. Price-fixing enforcement shifted toward bid-rigging violations affecting small markets (Connor 2001:66-68). U.S. antitrust authorities failed to investigate ADM's attempt to monopolize the lysine industry when it prevented Degussa's entry in 1989 and ADM's acquisition of Pfizer's citric-acid assets in 1990, both key events in the formation of two important global cartels.[92] The European Union's allocation of anticartel resources may also be criticized as inadequate up until at least the late 1990s. Another policy of the European Commission that inadvertently contributed to cartel effectiveness was the sponsorship of industry trade associations that became ideal covers for illegal price-fixing discussions for global cartelists. These organizations were also used to threaten trade reprisals against suppliers that remained outside the cartel.

Fashioning Remedies

The major objective of anticartel policies should be to lower the benefits (profits) or raise the costs (penalties) of price fixing. Other than vigilance in merger control, public policies can do little to change the structural features of markets that make cartels profitable: inelastic demand, large numbers of buyers, economies of scale, homogeneity, and so forth. Policies can sometimes have effects on trading conditions, such as the publication of transaction prices in

[92] The EU may also have missed a potential monopolization infraction when Ajinomoto took steps in the early 1970s that prevented Rhône-Poulenc's entry into lysine manufacturing.

markets characterized by lack of transparency. However, the principal role for antitrust is to develop rules, laws, and investigative procedures that make punishment surer and harsher than at present. Reforms should be implemented soon because the present favorable public and legislative support may not last.

It is clear from the geographic location of cartel meetings that, as a general rule, United States territory was avoided because of its well-deserved reputation for tough anticartel enforcement. Instead, conspirators met in Switzerland, Mexico, Japan, Hong Kong, and several EU cities that were regarded as less risky. This behavioral pattern is perhaps the best indicator that U.S. anticartel policies are the ones other jurisdictions should emulate.

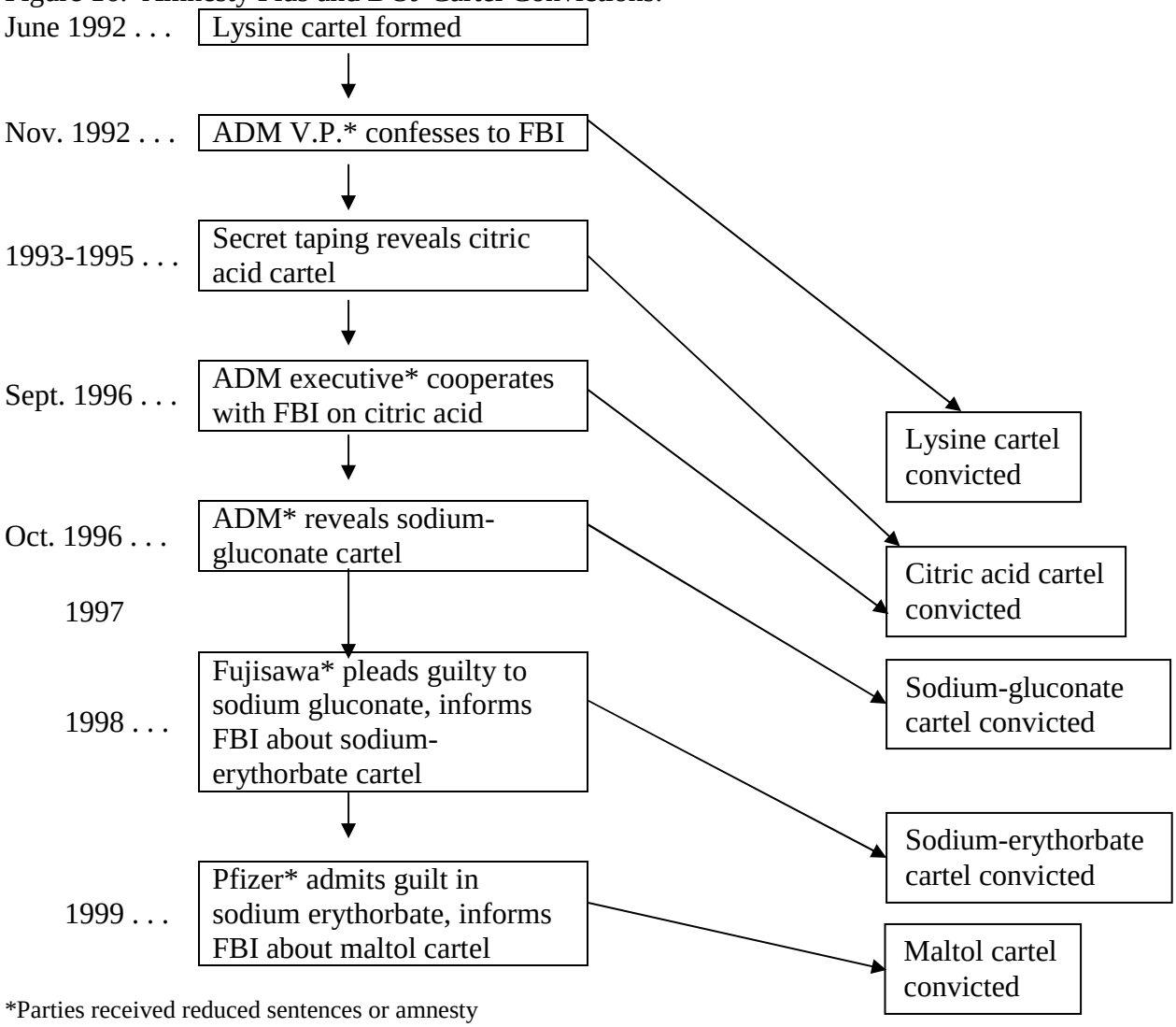
One investigative technique that has proven especially useful in discovering cartels is the DOJ's 1993 Leniency Program. Similar programs were subsequently adopted in Canada, the UK, Germany, Brazil, and the EU (Hammond 2001a:3). A novel variation is the "Amnesty Plus" program that rewards indicted companies if they inform the DOJ about collusive activity in a market not yet being investigated. In 2001, more than half of the DOJ's 30 global-cartel investigations were the result of Amnesty Plus leads (*ibid*.:6). More than three applications per month were received in early 2003 (Pate 2003). An example, admittedly the most productive one so far, is shown in Figure 16. Starting with 1992 information from one cooperating witness in 1992, the DOJ was able to leverage five global-cartel investigations into convictions of 10 companies, 11 executives, and $225 million in fines. A similar trail of connected cartel prosecutions occurred in the graphite-related and carbon related cartels (Pate 2003). Kovacic (2001) has suggested extending this program to give bounties to individuals.

An important issue facing the U.S. courts is the status of wholly foreign purchasers from global cartels under the Sherman Act. In particular, should a foreign (i.e., non-U.S.) entity that buys cartelized products at artificially high prices outside the United States be permitted to seek treble damages in U.S. courts? Such purchases are usually necessary in order to maintain the high U.S. prices; that is foreign injuries are a *sine qua non* for domestic injuries. Therefore, the plain language of the Sherman Act would appear to permit standing by wholly foreign buyers, were it is not for contrary limiting language in the Foreign Trade Antitrust Improvements Act (Davis 2003).

Permitting wholly foreign buyers to use U.S. courts would by itself increase the expected financial losses from global cartels and, thus, increase deterrence. On the other hand, such suits might strain U.S. judicial resources and would have a negative impact on the number of DOJ leniency applications by international cartelists. Judicial resources could be expanded by charging foreign buyers who pay no U.S. taxes a users' fee, which could fund the employment of court-appointed special masters to deal with such cases. Special masters are quite capable of holding hearings exclusively for foreign buyers because such buyers only have standing if domestic plaintiffs have already filed against the same defendants. Leniency applications would decline because the DOJ has no authority to intervene in private suits, and permitting wholly foreign plaintiffs to sue for treble damages would increase potential applicants' liability. The net effects on deterrence of these opposing forces is a matter worthy of study, but I would hazard the hypothesis that standing for wholly foreign buyers in U.S. courts will tend to increase global-cartel deterrence.

Other U.S. policies worthy of globalization include: fines based on multiples of overcharges rather than arbitrary percentages, increased penalties for recidivists, encouragement of private antitrust suits, and the criminalization of antitrust violations. This last initiative is especially important because it reduces the number of safe havens for fugitives from U.S. antitrust laws. These policy reforms are especially needed in Japan (which has an arbitrary fine of 6 percent of sales for price fixing by manufacturers) and other industrialized Asian countries (Chemtob 2000, Hammond 2001a).

Figure 16. Amnesty Plus and DOJ Cartel Convictions.



*Parties received reduced sentences or amnesty

U.S. anticartel policies themselves are hardly above criticism. Periods of weak enforcement seem to be associated with clusters of cartel-formation, such as occurred in the 1930s and 1980s. While it is treacherous to second-guess the decisions of DOJ prosecutors, there seems to be a pattern of overly generous fine discounts being given routinely to late-arriving cartel members; actual discounts are often bigger than the stated discount policy. Given

the relatively low levels of fines and private settlements outside the United States, consideration should be given to calculating fines routinely on the basis of *global* sales of the cartelized product, rather than as the rare exception it is today. Then DOJ threats of imposing fines "as high as 80 percent" of the value of affected commerce might really approach full deterrence levels.[93]

Many legal writers believe that personal penalties may have more deterrence value than corporate fines. The present U.S. Sherman Act cap of $350,000 has little punishment value for most multi-millionaire executives convicted for criminal price fixing in recent years. An alternative fine statute, first applied in 2002 litigation, should be made the new standard; at least Congress needs to clarify to the judiciary when it should be applied (see Connor 2001:434-436). As to prison sentences, three years may be too low a limit. Other countries have five-year maximum sentences for the same offense. The DOJ has been criticized for overuse, of at least unjustified use, of grants of immunity for top executives; closer supervision of these concessions by the courts is warranted. On the other hand, a small somewhat clearer policy is needed on granting immunity to "whistle-blowers" or cooperating witnesses, akin to automatic amnesty available for corporations.

Finally, nongovernmental solutions to price-fixing behavior should be explored (Connor 2001:542-547). Companies should implement internal antitrust compliance programs: training in legal standards of behavior, formal involvement in monitoring of contacts with rivals by corporate counsel, confidential whistle-blower communication methods, guidelines for dismissal of guilty employees, and surprise audits of participation of employees in trade-association meetings (Kolasky 2002).[94] Governance structures are critical if companies are to avoid future price-fixing allegations. In particular, boards of directors must be composed of a majority of members independent from management and outsiders should be the majorities on the all-important nomination and audit committees of the board.

[93] Hammond (2001a) mentions this figure. It assumes the usual 10-percent overcharge level, which is automatically doubled and then multiplied by a culpability index as high as 4.5. However, among the better documented global cartels in Tables 7 and A.2, the average overcharge was close to 25 percent of affected sales. Therefore, fines as high as 225 percent of U.S. sales during the conspiracy are in fact credible, or even 800 percent if the DOJ were to base its fine on *global* affected sales.

[94] Federal legislation passed by Congress in July 2002 mandates the Securities and Exchange Commission to establish standards of professional conduct for lawyers who practice before the SEC. Lawyers will be required to report evidence of fraud or other misconduct by corporate managers to the firm's CEO or, if no action is taken, to the board of directors (Schmit 2002). This rule originated from a letter from 40 law-school professors that cited ethical concerns about the role of lawyers in the Enron Corp. scandal.

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Appendix Table 1 List of International Cartels, by Type.

Name	Product			Affected Areas			
	Organ. Chem.	Food/ Agric.	Other	North America	EU	Asia	Other
1. Adhesive label stock*			X	US			
2. AIIC translators' assn.			X	US			
3. Aluminum phosphide	X	X		X			
4. Anti-anxiety drugs			X	US			
5. Asphalt, Sweden*			X		SW		
6. Asphalt paving, Finland			X		X		
7. Auditing services, IT			X		X		
8. Auto refinishes*			X	X	X		
9. Ball bearings, France			X		X		
10. Beef, France		X			FR		
11. Beer, France*		X			FR		
12. Beer, Belgium, HORECA		X			BL		
13. Beer, Belgium, Pvt. Label		X			BL		
14. Beer, Italy *		X			IT		
15. Beer, Portugal *		X			PT		
16. Beer, Netherlands *		X			NL		
17. Beta carotene	X	X		X	X	X	X
18. Bicycles, NL			X		NL		
19. Biotin (vitamin H)	X	X		X	X	X	X
20. Bitumen*	X				X		
21. Bridge, California			X	US			
22. Bridges, cable-stayed			X	US			
23. British sugar, UK		X			UK		
24. Bromines	X			X	?	?	
25. Calcium carbide*	X				X		
26. Carbon black*	X			X	X		
27. Carbon cathode block			X	X	X	X	
28. Carbon electrical products			X	X	?		
29. Carbon fiber*	X			X		X	
30. Carbonless paper, EU			X		X		
31. Carotenoids	X	X		X	X	X	X
32. Cartonboard			X		X		
33. Cement, EU			X		X		
34. Cement, IT*			X		IT		
35. Cement, DE, 1993-2003			X		DE		

36. Cement, Hungary			X		HU		
37. Cigarettes, IT		X			IT		
38. Citric acid	X	X		X	X	X	X
39. Compressed gas, Canada			X	CN			
40. Compressed gas, NL			X		NL		
41. Compressors, Australia			X				X
42. Concrete, Germany			X		X		
43. Concrete engineering, NL			X		X		
44. Construction, marine			X	X	X	X	X
45. Construction, sports tracks, NL			X		X		
46. Construction, NOR*			X		NOR		
47. Construction, NL*			X		NL		
48. Construction, USAID			X	X			X
49. Copper concentrates*			X	X	X	X	X
50 Copper tubes			X		X		
51. Creosote*	X			US	X		
52. Cosmetics, US			X				
53. Danish air route			X		X		
54. Diabetes testing devices, Italy			X		X		
55. Diesel fuel, Italy			X		X		
56. Distribution, elec. goods, FR			X		X		
57. District heating pipe			X		X		
58. DRAMs*			X	X	X	X	X
59. Drugs, OTC, commissions*			X	US			
60. Elevator repair services, Italy			X		X		
61. EPDM synthetic rubber*	X			X	X	X	
62. Euro zone banks			X		X		
63. Explosives, commercial			X	US			
64. Extruded graphite	X				X		
65. Ferries, Adriatic			X		X		
66. Ferries, channel			X		X		
67. Ferrosilicon	X			X			X
68. Fine art auctions			X	X	X		
69. Flat glass, U.S.			X	X			
70. Folic acid	X	X		X	X	X	X
71. Fuels, military, Japan			X			X	
72. Fuels, military, Korea			X			X	
73. Gasoline, Spain			X		ES		

74. Gasoline, Italy			X		IT		
75. Gasoline, Sweden			X		SW		
76. Gasoline, Netherlands			X		NL		
77. Gasoline, Czech Republic			X		CZ		
78. Gasoline, France			X		FR		
79. Gasoline, Chile*			X		CL		
80. Generic drugs, UK*			X		UK		
81. Glass containers, Italy			X		X		
82. Glass containers, US			X	X			
83. Graphite electrodes			X	X	X	X	
84. Glyphosate insecticide*	X	X		X	X	X	X
85. Holographic printing, U.S.			X	X			
86. Hydrogen peroxide*	X				X		
87. Inland chemical barges*			X		X		
88. Insecticide, BT, Canada	X	X		CN			
89. Insecticides, synthetic, Canada	X	X		CN			
90. Insurance, Netherlands			X		X		
91. Insurance, industrial, DE*			X		DE		
92. Iron oxide			X	CN			
93. Isostatic graphite	X			X	X	X	
94. Label stock, US			X	US			
95. LdPE Plastic	X				X		
96. Lysine	X	X		X	X	X	X
97. Magnetic iron oxide			X	X		X	
98. Matches, Italy			X		X		
99. Maltol, synthetic	X	X		X			
100. MBS*	X			X	X	X	
101. MCAA	X	X		X	?		
102. Methionine	X	X		X	X		
103. Methylglucamine	X			X	X	X	X
104. MMA*	X				X		
105. Mobile phones, Italy			X		X		
106. Mobile phones, NL			X		NL		
107. Mobile phones, UK*			X		UK		
108. Mobile phone fees, UK & Germany			X		UK/DE		
109. MSG	X	X		X	X	X	
110. Naphthalene*	X				X		
111. Nucleotides	X	X		X	X		

112. Organic peroxides	X	X		X	X		
113. Oxo-alcohols*	X				X		
114. Paper, office, Canada			X	X			
115. Paper, thermal fax			X	X			
116. Parcel tankers, chemical*			X	X	X	X	X
117. Pharmaceuticals, cholesterol, IT			X		X		
118. Pharmaceuticals, obesity, IT			X		X		
119. Pharmaceuticals, respiratory, IT			X		X		
120. Plasterboard			X		X		
121. Plastic dinnerware			X	X			
122. Polyester staple*	X			US			
123. Power equipment, Norway			X		X		
124. Prawns, Netherlands		X			NL		
125. PVC heat stabilizers*	X			X	X	X	
126. PVC impact modifiers*	X			X	X	X	
127. PVC plastic	X				X		
128. Radiological media, Italy			X		X		
129. Recorded music, Italy			X		X		
130. Rubber processing chemicals*	X			X	X		
131. Seamless steel tubes			X		X		
132. Shipping, FETTSCA (Far East)			X		X	X	
133. Shipping conference, FEFC			X		X		
134. Shipping (French – AF.)			X		X		X
135. Shipping, TACA (No. Atlantic)			X	X	X		
136. Shipping (W. Cent. Afr.)			X		X		X
137. Soda ash			X		X		
138. Sodium erythorbate	X	X		X			
139. Sodium gluconate	X	X		X	X		
140. Sorbates	X	X		X	X	X	
141. Stamp auctions*			X	X	X		
142. Steel beams			X		X		
143. Steel, flat stainless			X		X		
144. Sulfuric acid*			X	US			
145. Tactile tile, U.S.			X	X			
146. Tampico fiber		X		X			
147. Tar pitch*	X				X		
148. 3 Tenors CD			X	X	X		
149. Toys & games, UK			X		UK		

150. Transformers, power, Australia			X			AU	
151. Transport, marine			X	X	X	X	X
152. Tubes, laminated			X	US			
153. Vitamins A & E	X	X		X	X	X	X
154. Vitamin B1	X	X		X	X	X	X
155. Vitamin B2	X	X		X	X	X	X
156. Vitamin B3	X	X		X			
157. Vitamin B4 (Europe)	X	X			X		
158. Vitamin B4 (NAFTA)	X	X		X			
159. Vitamin B5	X	X		X	X	X	X
160. Vitamin B6	X	X		X	X	X	X
161. Vitamin B12	X	X		X	X		
162. Vitamin C	X	X		X	X	X	X
163. Vitamin D3	X	X		X	X	X	X
164. Vitamin premixes	X	X		X	?		
165. Water heaters, gas, Italy			X		X		
166. Wine alcohol auctions, EU*	X	X		X	X		
167. Zinc phosphate			X		X		

* Investigation underway, 2003, no prosecutions announced.
? = Not known, but suspected
X = Prices fixed in 2 or more countries; in North America, U.S. and Canada.
US = Prices fixed in US only
CN = Prices fixed in Canada only
FR = Prices fixed in France only
BL = Prices fixed in Belgium only
NL = Prices fixed in Netherlands only
PT = Prices fixed in Portugal only
IT = Prices fixed in Italy only
CZ = Prices fixed in Czechoslovakia only
AU = Prices fixed in Australia only
DE = Prices fixed in Demark only
SW = Prices fixed in Sweden only
HU = Prices fixed in Hungary only
NOR = Prices fixed in Norway only
ES = Prices fixed in Spain only

Appendix Table 2. International Cartels Prosecuted by the U.S. DOJ, Corporate Fines, by Year, 1990-2003.

Year [a]	Product	Company/Parent (HQ country)	Fine
			$ millions
1993	Aluminum phosphide	Detia-Degesch (DE)	0.290
		Detia Freyburg (DE)	0
		Inventa Corp./ United Phosphorus, Ltd. (India)	0[c]
		Pestcon Systems (US)	0.200
		Casa Bernado, Ltd. (Brazil)	0.005
			0.495
1994	Thermal fax paper, jumbo rolls	Kanzaki Paper Manufacturing (JP)	4.30
		Kanzaki Specialty Papers (JP)	4.50
		Mitsubishi Paper Mills / Mitsubishi Corp. (JP)	1.80
		Mitsubishi International / Mitsubishi Corp. (JP)	1.26
		Oji Paper Company (JP)	0.20
		Honshu Paper (JP)	0.23
		Appleton Papers (US)	0[c]
		Nippon Paper Industry (JP)	0[c]
			12.46
1994	Plastic dinnerware, disposable foodservice	Comet Plastics (US)	4.20
		Plastics Inc. / Newell Company (US)	4.16
		Polar Plastics Ltd. (CN)	0.46
		Dispoz-O-Plastics (US)	--
		Amcel Corp. (US)	--
			9.14
1995	Ferrosilicon	Elkem Metals (NOR)	1.00
		American Alloys (US)	0.10
		SKW Metals & Alloys (US)	0.15
		Globe Metallurgical (US)	0[d]
		Applied Industrial Materials (US)	0[d]
			1.28
1995	Explosives, commercial	Dyno Nobel / Norsk Hydro (NOR)	15.00[g]
		ICI Explosives / Imperial Chemical Industries (UK)	10.00
		Mine Equipment & Mill Supply / Dyno Nobel (NOR)	1.90
		Austin Powder (US)	7.00
		ETI Explosives (US)	0.95
		Dynablast EMSCO (US)	0
		Du Pont (US)	0
			34.85

Year [a]	Product	Company/Parent (HQ country)	Fine
1996	Lysine (G)	ADM Company (US)	70.00[g]
		Heartland Lysine / Ajinomoto (JP)	10.00
		Biokyowa / Kyowa Hakko (JP)	10.00
		Sewon America / Sewon (KO)	1.25
		Cheil Jedang (KO)	1.25
			92.50
1996	Citric acid (G)	ADM Company (US)	30.0
		Haarmann & Reimer / Bayer (DE)	50.0
		Hoffmann-La Roche (CH)	14.0
		Jungbunzlauer International (CH)	11.0
		Cerestar / Eridania (FR)	0.40
			105.40
1996	Tampico fiber	A & L Mayer Associates (US)	0.70
		Ixtlera de Santa Caterina (MEX)	0.75
		MFC Corporation (US)	0.75
		Fibros Saltillo (MEX)	0
			2.20
1996	Laminated tubes	American National Can (US)	0[e]
		KMK Maschinen (CH)	0[e]
			0
1997	Sodium gluconate (G)	PMP Fermentation Products / Fujisawa Pharmaceuticals (JP)	20.00
		Jungbungzlauer AG (CH)	0[b]
		Glucona / Avebe AB (NL)	5.00
		Glucona / Akzo Nobel Chemical (NL)	5.00
		Roquette Freres SA (FR)	2.50
		ADM Company (US)	0[b]
			32.50
1998	Construction services, heavy-lift marine (G)	HerreMac / Heerma (CH)	49.00
		J. Ray McDermott Company (US)	0[b]
		Saipem/ ENI (IT)	Pending
		Bouygues (FR)	?
		ETPM (FR)	?
		Offshore Pipelines, Inc. (US)	?
		Hyundai (KO)	?
		NPCC (Abu Dhabi)	?
			49.00

Year [a]	Product	Company/Parent (HQ country)	Fine
1998	Transport services, heavy-lift marine (G)	Dockwise NV (BL)	15.00
		Dockwise USA (US)	1.00
		J. Ray McDermott Company (US)	0[b]
		Heerma (CH)	Pending
		Saipem / ENI (IT)	Pending
			16.00
1998	Anti-anxiety drugs, generic	Mylan Laboratories (US)	100.00[g]
		Cambrex (US)	0
		Profarmaco / Cambrex (IT)	0
		Gyma Laboratories (US)	0
			100.00
1998	Sorbates (sorbic acid, salts of sorbic acid) (G)	Hochest / Aventis (DE)	36.00
		Daicel Chemical Industries (JP)	53.00
		Nippon Gohsei (JP)	21.00
		Ueno (JP)	11.00
		Eastman Chemical (US)	11.00
		Chisso (JP)	Pending
		Monsanto (US)	?
			131.00
1998	Graphite electrodes (G)	UCAR International (US)	110.00[g]
		SGL Carbon AG (DE)	135.00
		Showa Denko Carbon (JP)	32.50
		SEC Corporation	13.30
		Nippon Carbon (JP)	2.50
		Tokai Carbon (JP)	6.00
		Carbon / Graphite (US)	0[b]
		Mitsubishi Corporation (JP)	134.00
		Union Carbide (US)	Pending
			433.30
1998	Niacin & Niacinamide (Vitamin B3) (G)	Lonza / Alusuisse (CH)	10.50
		Degussa – Huels (DE)	13.00
		Napera (US)	4.00
		Reilly Industries (US)	2.00
			29.50

Year [a]	Product	Company/Parent (HQ country)	Fine
1999	Bulk vitamins A, E, C, B1, B5, carotenoids, and premixes [six cartels] (G)	Hoffmann – La Roche (CH)	500.00[g]
		BASF (DE)	225.00
		Rhone-Poulenc / Aventis (FR)	0[b]
		Takeda Chemical Industries (JP)	72.00
		Daiichi Pharmaceuticals (JP)	25.00
		Eisai Company (JP)	40.00
		E. Merck (DE)	14.00
			876.00
1999	Choline chloride (Vitamin B4), NAFTA branch	Chinook Group Ltd. (CN)	5.00
		DuCoa LP / DCV (US)	0.50
		Bioproducts / Mitsui (JP)	Pending
		DCV Holdings Inc. (US)	0
		ConAgra Inc.	0
		DuPont	0
			5.50
1999	Choline Chloride, EU Branch	BASF AG (DE)	?
		Akzo Nobel NV (NL)	?
		UCB (BL)	?
1999	Sodium erythorbate	Pfizer Corporation (US)	10.00
		Fujisawa Pharmaceutical (JP)	0[b]
		Cheil Jedang (SO)	?
			10.00
1999	Maltol	Pfizer Corporation (US)	10.00
		F & S Alloy & Minerals (US)	0[b]
		Otsuka Chemical (JP)	?
			10.00
2000	Bromines	Great Lakes Chemical (US)	0[b]
		Dead Sea Bromine (IS)	7.00
		Albermarle (US)	?
			7.00
2000	Construction, USAID, Egypt wastewater plants	Philipp Holzmann AG (DE)	30.00
		American International Contractors (US)	4.20
		ABB Asea Brown Boveri (SW/CH)	53.00
		Bilhar International Establishments (Leicht.)	54.00
		Bill Harbert International Construction (US)	0

Year [a]	Product	Company/Parent (HQ country)	Fine
2000	Bridge, california post-tensioning	Avar Construction Systems (US)	Pending
		Diwidag-Systems International USA (US)	0.757
			0.757
2000	Bridges, cable-stayed (4 States)	Freyssinet International (FR)	0.720
		Diwidag-Systems International USA (US)	0.571
			1.291
2000	Fine art auctions (G)	Sotheby's (US)	45.00
		Christie's / Artemis (FR)	0[b]
			45.00
2000	Tactile tiles	ADA Fabricators/AMS Tactile Systems (US)	0.08
		Ontario Limited (CA)	Pending
2001	MSG and other nucleotides (IMP,GMP) (G)	Ajinomoto Company (JP)	6.00
		Takeda Chemical Industries (JP)	Pending
		Sewon / Daesang Corporation (SO)	0.01
		Cheil Jedang (SO)	3.00
		ADM Company (US)	0[b]
		Kyowa Hakko (JP)	0
		Deko International (JP)	0
		Tung Hai Fermentation (TW)	0
			9.01
2001	MCAA, methylchloroacetic acid (G)	Elf Atochem (FR)	5.00
		Akzo Nobel Chemical (NL)	12.00
		Clariant AG (DE)[g]	0[b]
		Hoechst / Aventis (DE)[h]	12.00
			29.00
2001	Organic peroxides (seven chemicals) (G)	Elf Atochem/ElfAtoFina (FR)	3.50
		Akzo Nobel Chemicals (NL)	Pending
		Aztec Peroxides LLC (?)	Pending
		Crompton (US)	0[b]
		Degussa-Huels (DE)	?
		Laporte PLC (?)	?
		Hercules (US)	?
			3.50

Year [a]	Product	Company/Parent (HQ country)	Fine
2001	Isostatic graphite (G)	Toyo Tanso (JP)	4.50
		Ibiden Company (JP)	3.60
		Carbone America / Carbone-Lorraine (FR)	7.15
		SGL Carbon (DE)	0
		GrafTech (UCAR) (US)	0[b]
			15.25
2002	Carbon cathode block (G)	Anchor Industrial Products (US)	0.60
		Nippon Electrode (JP)	0.45
		VAW Carbon (DE)	0.99
		Hepworth Refractories (UK) ?	0[b]
			2.04
2002	Stamp auctions (G)	Stephen Osborn Ltd. (UK)	Pending
		Anthony Feldman (UK)	Pending
		Earl P.L. Apfelbaum (US)	Pending
		Davitt Felder Inc. (US)	Pending
		Mark Marrow Stamps (US)	Pending
		Dana Okey (US)	Pending
		Etienne de Cherisey (FR)	Pending
		Kees Quirijins (NL)	Pending
		Others	Pending
			0
2002	Carbon electrical products (G)	Morganite Inc. / Morgan Crucible (UK)	11.00
		Others	Pending
			11.00
2002	Polyester staple	Arteva Specialties (Luxem.)	28.50
		Nanya Plastics Corporation (TW)	Pending
			28.50
2002	Carbon fiber (G)	Toho Tenax (JP)	0.50
		Toray industries (JP)	Pending
		Mitsubishi rayon/ Mitsubishi (JP)	pending
2003	Magnetic iron oxide (G)	Ishihara Sangyo Kaisha (JP)	5.00
		Ibiden Company (JP) ?	0[b]
			5.00
		40 Cartels, 35 Cases, July 2003 Grand Total	**2,250.23**

	PROBABLE	POSSIBLE
2003-2005 (forth-coming)	Carbon Black	Methionine Amino Acid
	Carbon Fiber	Wine Alcohol Auctions
	Methylglucamine	Glyphosate Insecticide
	Parcel Tankers, Chemical	Vitamin B1
	PVC Plastic Additives	Vitamin B2
	EPDM Synthetic Rubber	Vitamin B12
	DRAMs, Semiconductors	Folic Acid (B)
	Creosote	Vitamin D3
	Tar Pitch	Biotin (Vitamin H)
	Naphthalene	Vitamin B4, EU Branch
	Auto Refinishes	Extruded Graphite
	Sulfuric Acid	

G= Global-scope cartel
? = Possible future indictment; apparent target of investigation or defendant in private suit.
-- = Not available
[a] The year of the date of the first guilty plea or conviction at trial; some convictions may have occurred at a later date.
[b] Convicted but granted U.S. government amnesty.
[c] Indicted but found not guilty at trial or hung jury.
[d] Un-indicted co-conspirator.
[e] No fine; settled by consent decree.
[f] Exposed by Canadian Bureau of Competition in 1999 but not prosecuted; may be under investigation by the EU.
[g] A record U.S. fine at the time.
[h] Hoechst colluded 1995-97; in 1997, the MCAA unit was sold to Clariant

Appendix Table 3. Time Lag in Anti-cartel Enforcement, 1990-2003.

Type: Cartel Name	Dates of First Discovery or Sanctions [a]				Lags in Months		
	First Date	U.S. DOJ	CCB	EC & Other	Discovery to First Sanction	U.S To CCB	U.S. or CN to EC
Global Food:							
Lysine	6/95 US	8/96	5/98	6/00 EC, 1998 MX	14	21	46
Citric Acid	10/96 US	10/96	5/98	12/01	0	19	50
Sodium Gluconate	9/97 US	9/97	10/98	10/01	0	11	51
Sorbates	9/98 US	9/98	10/99	--	0	13	--
Vitamins A & E	5/99 US	5/99	9/99	11/01	0	4	30
Vitamin B1	5/99 EU	--	--	11/01	30	--	30
Vitamin B2	5/99 US	5/99	9/99	11/01	0	4	30
Vitamin B5	5/99 US	5/99	9/99	11/01	0	4	30
Vitamin B6	5/99 EU	--	9/99	11/01	30	4	26
Vitamin C	5/99 US	5/99	9/99	11/01	0	4	30
Folic acid	5/99 EU	--	--	11/01	30	--	0
Vitamin D3	5/99 EU	--	--	11/01	30	--	0
Biotin (Vitamin H)	5/99 EU	--	--	11/01	30	--	0
Carotenoids	5/99 US	5/99	9/99	11/01	0	4	30
Beta Carotene	5/99 US	5/99	9/99	11/01	0	4	30
Vitamin B3	5/99 US	5/99	5/99	--	0	4	--
Vitamin premixes	5/99 US	5/99	9/99	11/01	0	4	30
Vitamin B12	10/99 CN	--	10/99		0	--	--
Methionine	11/99 EU	--	--	7/02	32	--	0
Organic peroxides (seven)	3/01 US	3/01	--	--	0	--	--
MCAA	6/01 US	6/01	--	6/02	0	--	12
MSG	8/01 US	8/01	--	12/02	0	--	16
Nucleotides	8/01 US	8/01	--	12/02	0	--	16
Wine alcohol auctions	4/02 US	--	--	--	--	--	--
Subtotal	**24**	**16**	**15**	**19**	**196**	**100**	**471**

Type: Cartel Name	Dates of First Discovery or Sanctions				Lags in Months		
	First Date	U.S. DOJ	CCB	EC & Other	Discovery to First Sanction	U.S To CCB	U.S. or CN to EC
Regional EU Food:							
British sugar	6/93 EU	--	--	10/98	64	--	--
Vitamin B4, EU	9/99 CN	--	9/99	4/03	0	--	42
Belgian beer, HORECA	10/99 EU	--	--	12/01	22	--	0
Belgian beer, store label	10/99 EU	--	--	--	--	--	--
Portugal beer	1/03 EU	--	--	--	--	--	--
French beer	1/03 EU	--	--	--	--	--	--
Dutch beer	1/03 EU	--	--	--	--	--	--
Italian beer	1/03 EU	--	--	--	--	--	--
Subtotal	**8**	**0**	**1**	**3**	**86**	**0**	**42**
Other Regional Food:							
Insecticides, chemical	6/93 CN	--	6/93	--	0	--	--
BT insecticide	6/93 CN	--	6/93	--	0	--	--
Aluminum phosphide	10/93 US	7/94	--	--	9	--	--
Tampico fiber	5/96 US	5/96	--	--	0	--	--
Vitamin B4, NAFTA	2/99 US	3/99	9/99	--	1	6	--
Maltol	7/99 US	7/99	--	--	0	--	--
Sodium erythorbate	7/99 US	7/99	10/01	--	0	27	--
Infant formula, IT	3/00 IT	--	--	3/03 IT	0	--	--
Cigarettes, Italy	6/01 IT	--	--	3/03 IT	21	--	--
Beef, France	1/02 FR	--	--	4/03 FR	15	--	--
Prawns, Netherlands	1/03 NL	--	--	1/03 NL	0	--	--
Glyphosate, US	3/03 US	--	--	--	--	--	--
Subtotal	**12**	**5**	**4**	**4**	**46**	**33**	**--**
Global Nonfood:							
Shipping, France –W.Africa	1/92 EU	--	--	1/92	0	0	0
Shipping, Europe/W. Cent Africa	4/92 EU	--	--	4/92	0	--	0
TACA shipping conference	10/94 EU	--	--	9/98	47	--	0
Graphite electrodes[b]	6/97 US	2/98	3/99	7/01 EC, 3/02 KO	8	11	29
Fine art auctions	6/97 US	10/00	--	4/02	40	--	18

Type: Cartel Name	Dates of First Discovery or Sanctions				Lag in Months		
	First Date	U.S. DOJ	CCB	EC & Other	Discovery to First Sanction	U.S. To CCB	U.S or CN to EC
FETTSCA Far East shipping Conference	5/00 EU	--	--	5/00	0	--	0
Carbon fiber	7/00 US	5/02	--	--	22	--	--
Isostatic graphite	2/01 US	2/01	3/01	12/02	0	1	22
Auto refinishes	6/01 US	--	--	--	--	--	--
Magnetic iron oxide	7/01 US	1/03	--	--	18	--	--
"3 Tenors" CDs	7/01 US	6/02	--	--	9	--	--
Stamp auctions	1/02 US	4/02	--	--	3	--	--
Carbon cathode block	3/02 US	3/02	--	--	0	--	--
DRAMs	6/02 US	--	--	--	--	--	--
Extruded graphite	9/02 EU	--	--	12/02	3	--	0
EPDM synthetic rubber	10/02 US/CN	--	--	--	--	--	--
Rubber processing chemicals	10/02 US+EU	--	--	--	--	--	--
Methylglucamine	11/02 EU	--	2/03	11/02	0	4	0
Electric carbon products	11/02 US	11/02	--	--	0	--	--
Carbon black	11/02 US+EU	--	--	--	--	--	--
Tar pitch	12/02 US+EU	--	--	--	--	--	--
Creosote	12/02 US+EU	--	--	--	--	--	--
Naphthalene	12/02 US+EU	--	--	--	--	--	--
MBS	2/03 US+JP+EU+ CN	--	--	--	--	--	--
PVC plastic impact modifiers	2/03 US+ EU+JP+CN	--	--	--	--	--	--
PVC plastic heat stabilizers	2/03 US+ EU+JP+CN	--	--	--	--	--	--
Parcel tankers, chem.	2/03 US+EU	--	--	--	--	--	--
Copper concentrate	5/03 US+EU+CN+ AUS	--	--	--	--	--	--
Subtotal	**28**	**9**	**3**	**9**	**150**	**16**	**69**
Regional EU Nonfood:							
PVC plastic	1/87 EU	--	--	12/88	23	--	0
LdPE plastic	1/87 EU	--	--	12/88	11	--	0
Soda ash	4/89 EU	--	--	12/90	20	--	0

Type: Cartel Name	Dates of First Discovery or Sanctions				Lags in Months		
	First Date	U.S. DOJ	CCB	EC & Other	Discovery to First Sanction	U.S To CCB	U.S. or CN to EC
Cement, Europe	1/92 EU	--	--	11/94	34	--	0
Steel beams	5/92 EU	--	--	2/94	21	--	0
Ferries, English Channel	11/92 EU	--	--	12/99	85	--	--
Carton board	7/94 EU	--	--	7/94	0	--	0
Ferries, Adriatic	7/94 EU	--	--	12/99	65	--	--
Seamless steel tubes	12/94 EU	--	--	12/99	60	--	0
District heating pipe	3/96 EU	--	--	10/98	31	--	0
Stainless steel, flat	1/98 EU	--	--	1/98	0	--	0
Plasterboard	11/98 EU	--	--	11/02	48	--	0
Euro-Zone banks	10/99 EU	--	--	7/00	9	--	0
Carbonless paper	8/00 EU	--	--	8/00	0	--	0
Copper tubes	5/01 EU	--	--	--	--	--	--
Danish air route	7/01 EU	--	--	7/01	0	--	0
Mobile phones, UK & DE	7/01 EU	--	--	--	--	--	--
Zinc phosphate	12/01 EU	--	--	12/01	0	--	0
Bitumen	10/02 EU	--	--	--	--	--	0
Calcium carbide	12/02 DE+NOR	--	--	--	--	--	--
Inland chemical barges	2/03 EU	--	--	--	--	--	0
Oxo-alcohols	3/03 EU	--	--	--	--	--	--
FEFC liner conference	3/03 EU	--	--	03/03	0	--	--
MMA	4/03 EU	--	--	--	--	--	--
Hydrogen peroxide	4/03 EU	--	--	--	--	--	--
Subtotal	**25**	**--**	**--**	**17**	**407**	**--**	**0**
Other Regional Non-Food:							
Glass containers, U.S.	6/83 US	--	--	--	156[c]	--	--
Compressed gases, Canada	6/90 CN	--	9/91	--	15	--	--
AAIC, US	?/94 US	--	--	7/96 US	24 ?	--	--
Ferrosilicon, US	1/94 US	9/95	--	--	21	--	--
Plastic dinnerware, US	6/94 US	6/94	--	--	0	--	--
Thermal fax paper, US	7/94 US	7/94	7/94	--	0	0	--
Cosmetics, U.S.	4/95 US	--	--	--	62[c]	--	--
Explosives, US	8/95 US	8/95	--	--	0	--	--
Tubes, laminated, US	6/96 US	6/96	--	--	0	--	--

Type: Cartel Name	Dates of First Discovery or Sanctions				Lags in Months		
	First Date	U.S. DOJ	CCB	EC & Other	Discovery to First Sanction	U.S To CCB	U.S. or CN to EC
Flat glass, US	6/97 US	--	--	6/00 US	36[c]	--	--
Glass containers, Italy	7/97 IT	--	--	7/97 IT	0	--	--
Iron oxides, Canada	8/97 CN	--	--	--	--	--	--
Recorded music, Italy	10/97 IT	--	--	10/97 IT	0	--	
Construction, heavy-lift marine, US	12/97 US	12/97	--	--	0	--	--
Transport, heavy-lift marine, US	12/97US	12/97	--	--	0	--	--
Power -equipment, hydro, NOR	6/98 NOR	--	--	5/99 NOR	9	--	--
Anti-anxiety drugs, US	12/98 US	--	--	--	0	--	--
Auditing services, Italy	12/98 IT	--	--	2/00 IT	15		
Cell phones, Italy	1/99 IT	--	--	10/99 IT	9	--	--
Drugs, respiratory, Italy	3/99 IT	--	--	3/99 IT	0	--	--
Drugs, cholesterol, Italy	3/99 IT	--	--	3/99 IT	0	--	--
Compressors, Australia	4/99 AU	--	--	6/99 AUS	2	--	--
Gasoline, Spain	5/99 ES	--	--	6/01 ES	13	--	--
Water heaters, Italy	5/99 IT	--	--	5/99 IT	0	--	--
Concrete, Germany	8/99 DE	--	--	11/99 DE	3	--	--
Gasoline, Italy	10/99 IT	--	--	6/00 IT	9	--	--
Fuels, military, Japan	10/99 JP	--	--	11/99 JP	1	--	--
Drugs, obesity, Italy	12/99 IT	--	--	12/99 IT	0	--	--
Bridge, California, US	1/00 US	1/00	--	--	0	--	--
Gasoline, Sweden	2/00 SW	--	--	6/00 SW	4	--	--
Elevator repair, Italy	5/00 IT	--	--	5/00 IT	0	--	--
Bromines, US	7/00 US	7/00	--	--	0	--	--
Fuels, military, Korea	7/00 KO	--	--	3/02 KO	20[b]	--	--
Match distribution, Italy	7/00 IT	--	--	7/00 IT	0	--	--
Construction, USAID	8/00 US	8/00	--	--	0	--	--
Bridges, cable-stayed, US	8/00 US	8/00	--	--	0	--	--
Tactile tiles, U.S.	8/00 US	8/00	--	--	0	--	--
Radiological media, Italy	11/00 IT	--	--	11/00 IT	0	--	--
Transformers, Australia	4/01 AU	--	--	5/02 AUS	13	--	--
Mobile phones, UK	7/01 EU	--	--	--	--	--	--
Mobile phones, NL	9/01 NL	--	--	12/02 NL	15	--	--

Type: Cartel Name	Dates of First Discovery or Sanctions				Lags in Months		
	First Date	U.S. DOJ	CCB	EC & Other	Discovery to First Sanction	U.S To CCB	U.S. or CN to EC
Gasoline, Netherlands	12/01 NL	--	--	6/02 NL	7	--	--
Construction, Netherlands	1/02 NL	--	--	-- NL	?	--	--
Asphalt, Sweden	1/02 SW	--	--	3/03 SW	14	--	--
Generic drugs, UK	4/02 UK	--	--	-- UK	--	--	--
Distribution, appliances, FR	6/02 FR	--	--	6/02 FR	0	--	--
Industrial gases, NL	7/02 EU	--	--	7/02 EU	0	--	--
Insurance, Germany	7/02 DE	--	--	-- DE	--	--	--
Gasoline, Czech Republic	7/02 CZ	--	--	9/02 CZ	2	--	--
Cement, Germany	7/02 DE	--	--	4/03 DE	15	--	--
Gasoline, France	8/02 FR	--	--	4/03 FR	8	--	--
Polyester staple, US	9/02 US	9/02	--	--	0	--	--
Ball bearings, France	9/02 FR	--	--	9/02 FR	0	--	--
Cement, Hungary	10/02 HU	--	--	-- HU	--	--	--
Toys, UK	11/02 UK	--	--	2/03 UK	5	--	--
Bicycles, Netherlands	11/02 NL	--	--	11/02 NL	0	--	--
Concrete engineering, NL	11/02 NL	--	--	-- NL	--	--	--
Gasoline, Chile	12/02 CL	--	--	-- CL	--	--	--
Construction, sports, NL	12/02 NL	--	--	12/02 NL	0	--	--
Sulfuric acid, US	1/03 US/CN	--	--	--	--	--	--
OTC drugs, US	2/03 US	--	--	--	--	--	--
Construction, Norway	2/03 NOR	--	--	-- NOR	--	--	--
Diesel distribution, Italy	3/03 IT	--	--	3/03 IT	0	--	--
Cement, Italy	4/03 IT	--	--	--	--	--	--
Label stock, US	4/03 US	4/03	--	--	0	--	--
Paper, office, Canada	4/03 CA	--	--	--	--	--	--
Diabetes devices, Italy	4/03 IT	--	--	4/03 IT	0	--	--
Asphalt, Finland	6/03 FI	--	--	-- FI	--	--	--
Insurance, Netherlands	6/03 NL	--	--	-- NL	--	--	--
Printing, holographic, U.S.	7/03 US	--	--	--	--	--	--
Subtotal	**70**	**14**	**1**	**36**	**531**	**0**	**--**
Grand total	**167**	**45**	**24**	**88**	**1,416**	**149**	**582**

-- = Not applicable

[a] First date to appear in newspapers or wire reports of a raid or investigation. Sanction dates are press releases by the antitrust authorities of guilty pleas, indictments, or fines imposed on at least on party.
Sources: Tables A.1 to A.12
[b] Prosecuted by Korea's FTC in 3/02
[c] Date that a civil case was resolved.

Appendix Table 4. Severity of EU Cartel Fines, Nine Largest Cases[a]

Case (Date of Imposition): Company Name	Amount of Fine[b]	Global Sales of Company (fiscal year ending)[c]	Fine as a Proportion of [d]	
			Sales	Total Assets
	Million U.S. dollars		*Percent*	
VITAMINS (11/21/2001):				
Hoffman-LaRoche/Roche Holdings AG	405.3	17,798 (2000)	2.28	0.93
BASF AG	259.8	33,879 (2000)	0.77	0.67
Rhone-Poulenc/Aventis SA	4.4	12,687 (2000)	0.035	0.011
Lonza AG	0	--	0	0
Solvay SA	8.0	8,725 (2000)	0.092	--
Merck KgaA	8.3	7,528 (2000)	0.11	0.10
Daiichi Pharmaceutical Co. Ltd.	20.5	2,918 (2000)	0.70	0.43
Kongo Chemical	0	--	0	0
Sumitomo Chemical	0	--	0	0
Sumika Fine Chemicals Co. Ltd.	0	--	0	0
Takeda Chemical Industries	32.5	8,964 (2000)	0.36	--
Tanabe Seiyaku Co. Ltd.	0	--	0	0
Eisai Co.	11.6	2,937 (2000)	0.39	0.26
TOTAL	750.3	95,436	0.79	0.40
			(0.38)	(0.45)
PLASTERBOARD (11/27/2002):				
Lafarge SA	250.6	12,209 (2001)	2.05	0.94
BPB PLC	138.6	2,248 (2001)	6.17	5.26
Begrueder Knauf	85.8	Private	--	--
Gyproc Benelux NV	4.3	82.5 (2003)	5.21	--
TOTAL	478.3	14,540	2.70	3.10
			(5.21)	(3.10)
CARBONLESS PAPER (8/8/00):				
Arjo Wiggins Appleton PLC	166.0	5,205 (1999)	3.19	3.81
Papierfabrik A. Koehler Gmbh	29.8	Private	--	--
Zanders Feinpapiere AG	26.8	625 (1999)	4.29	5.59
Bollore' GROUPE SA	20.4	5,173 (2002)	0.39	--
Mitsubishi Hi Tech Paper/Mitsubishi Corp.	19.1	113,844 (1999)	0.017	0.0257
Torraspapel SA	12.8	926 (2001)	1.38	--
Papeteries Mougeot SA	3.3	167 (2002)	1.98	--
Distribudora Viscaina de Papeles	1.6	--	--	--
Carrs Paper Ltd.	1.4	26 (2002)	5.38	--
Pellera Zicuñaga SA	1.4	128 (2000)	1.09	--
TOTAL	282.6	126,094	0.20	1.92
			(1.68)	(3.81)

TACA Liner Conference (9/16/1998):					
Moller-Maersk A/S	23.7	77[f]	(1999)	30.78 (?)	3.18
Sea-Land Service, Inc.	23.7	--		--	--
P & O Nedlloyd	35.7	7,552	(2002)	0.47	--
OOCL/Orient Overseas Container Line	17.8	630	(1999)	2.83	6.33
NYK Line (Europe) Ltd.	17.8	43[f]	(2000)	41.49 (?)	56.78 (?)
Hanjin Shipping Co. Ltd.	17.8	3,540	(1999)	0.50	0.40
Hapag-Lloyd AG	17.8	7,839	(1999)	0.23	0.82
Hyundai Merchant Marine Ltd.	16.0	4,498	(1999)	0.36	0.36
MSC/Mediterranean Shipping Co.	11.9	Private		--	--
DSR/Senator Lines Gmbh	11.9	1,614	(2001)	0.74	--
NOL/Neptune Orient Lines	11.9	3,926	(1998)	0.30	0.16
Cho Yang Shipping Co.	11.9	Private		--	--
TMM/Tecomar SA	5.9	990	(2000)	0.60	--
ACL/Atlantic Container Line AB	5.9	308	(1997)	1.92	--
POL/Polish Ocean Lines	2.9	Private		--	--
TOTAL	235.9	31,017		0.59	1.65(7)
				(0.50)	(0.40)
GRAPHITE ELECTRODES (7/18/2001):					
UCAR International, Inc.	43.1	586	(2000)	7.35	4.75
SGL Carbon AG	68.5	1,190	(2000)	5.76	4.99
Showa Denko Carbon	14.1	6,536	(2000)	0.22	0.15
SEC Corp.	10.4	156	(2000)	6.67	3.51
Nippon Carbon Co. Ltd.	10.4	180	(2000)	5.78	2.74
Tokai Carbon Co. Ltd.	20.9	568	(2000)	3.68	2.26
Carbon/Graphite	8.8	Private		--	--
Mitsubishi Corp.	0	--		0	0
VAW AG	9.9	Private		--	--
TOTAL	187.2	9,198		2.04	3.06
				(5.76)	(2.74)
CITRIC ACID (12/5/2001):					
Archer Daniels Midland Co.	35.3	12,867	(2000)	0.27	0.24
Bayer AG	12.7	26,048	(2000)	0.049	0.037
Hoffmann-LaRoche/Roche Holdings AG	56.5	17,798	(2000)	0.32	0.13
Jungbungzlauer AG	15.7	207	(2001)	7.58	--
Eridania Beghin-Say SA	0.2	9,073	(1999)	0.0022	0.0022
TOTAL	120.4	65,993		0.18	0.10
				(0.27)	(0.84)
METHIONINE (7/2/2003):					
Degussa-Huels AG	116.3	12,741	(1999)	0.91	1.19
Nippon Soda Co. Ltd.	8.9	1,170	(2001)	0.76	0.59
Rhone-Poulenc/Aventis SA	0	0		--	0
TOTAL	125.2	13,911		0.90	0.89
				(0.90)	(0.89)
CARTONBOARD (7/13/1994):					
Buchmann Gmbh	2.0	Private		--	--

Cascades SA	14.4	242 (1997)	5.95	6.55
Enso-Gutzeit Oy	2.9	Private	--	--
Europa Carton	2.1	484 (1996)	0.43	0.75
Finnboard Association	17.8	--	--	--
Fyskerby AB	0.9	--	--	--
Gruber & Webber Gmbh	0.9	80 (2002)	1.13	--
BPB PLC	1.6	2,125 (1999)	0.075	0.061
KNP BT Nederland	2.7	--	--	--
Laakmann Gmbh	2.0	Private	--	--
Mays-Meinhof	18.7	--	--	--
MoDo/Mo Och Domsjo AB	20.2	--	--	--
Papeteries de Lancy	1.3	--	--	--
Rena/ Kartonfabrik AS	0.2	39.5 (1993)	0.51	1.01
Sario AS	13.8	Private	--	--
SCA	2.0	--	--	--
Stora Billerud	10.0	842 (1993)	1.19	1.00
Enso Oy	1.6	15.2 (1993)	10.53	7.48
Moritz J. Weig Gmbh	2.7	220 (2001)	1.23	--
TOTAL	117.6	4,045	1.34	2.80
			(1.16)	(1.01)
LYSINE (6/2000):				
Archer Daniels Midland Co.	42.1	14,283 (1999)	0.30	0.29
Ajinomoto Co. Ltd.	25.1	6,780 (1999)	0.37	0.36
Kyowa Hakko Co. Ltd.	11.8	1,900 (1999)	0.62	0.29
Sewon/Daesang	7.9	849 (2000)	1.50	--
Cheil Jedong/ Cheil Industries, Inc.	10.9	1,003 (1999)	1.09	0.86
TOTAL	97.9	24,815	0.39	0.45
			(0.62)	(0.29)

-- = Not available or not applicable

Sources: Press releases of the European Commission and Worldscope, Disclosure Inc., or similar renderings of the income statements of the companies.

a) These 9 cases are the largest in terms of euro fines among all international cartels, as of July 2003, where the fines are the totals imposed on all companies by the EC or later by the European Court of First Instance, in euros or ECUs. Some recent cases are still under appeal in 2003.
b) Translated from euros to U.S. dollars at the average exchange rate prevailing during the three months following the date of imposition.
c) Fines are limited to 10% of worldwide sales in the year prior to the date of imposition; if not available, closest year available is shown.
d) Total for each case is weighted average for sales and simple average for assets. In parentheses is the median percentage.
e) Hard to believe but cross-checked extensively

Appendix Table 5. Repeat Offenders in International Cartels Discovered 1990-2003

Company (Country)	Membership in Cartels		Total Number
	Sanctioned[a]	Under Investigation[b]	
BASF (DE)	9 vitamins, PVC plastic, LdPE plastic	Auto refinishes, oxo-alcohols, sulfuric acid, MMA	15
Hoffmann-LaRoche (CH)	12 vitamins, citric acid		13
Total Fina Elf (FR)	MCAA, PVC plastic, LdPE plastic	Organic peroxides, PVC additives, oxo-alcohols, MMA, sulfuric acid, bitumen, gasoline, (IT,ES,FR)	12
Aventis (FR)	4 vitamins, sorbates, MCAA, methionine, PVC plastic, LdPE plastic, methlglucamine		10
Akgo Nobel (NL)	Sodium gluconates, MCAA, choline chloride, soda ash, explosives	Auto refinishes, organic peroxides, PVC additives, rubber processing chemicals, MBS	10
Degussa-Huels (DE)	Methionine, PVC plastic, vitamin B12	Organic peroxides, carbon black, oxo-alcohols, sulfuric acid, MMA, calcium carbide	9
Mitsubishi (JP)	Graphite electrodes, fax paper, carbonless paper, Isostatic graphite	Carbon fiber, carbon black, MBS, PVC additives	8
ADM (US)	Lysine, citric acid, MSG, sodium	Wine alcohol, fructose, glucose, dextrose	8
Shell (NL)	PVC plastic	Bitumen, retail gasoline (IT,SW, CZ,FR, Chile)	7
Bayer (DE)	Citric acid, LdPE plastic, BT insecticide	Iron oxide, EPDM, rubber processing chemicals	6
Takeda Chem. (JP)	4 vitamins, MSG		5
Du Pont (US)	Explosives, choline chloride	EPDM, auto refinishes, sulfuric acid	5
Solvay (BL)	Vitamin D, PVC plastic	Oxo-alcohols, sulfuric acid, MMA	5
Mitsui (JP)	Choline chloride, methionine, FETTSCA	EPDM	4
ICI (UK)	Explosives, soda ash, PVC plastic, LdPE plastic		4
Sumitomo Chemical (JP)	BT insecticide, vitamin H	EPDM	3
Lafarge (FR)	Cement, lysine	Cement (IT+DE)	4
Exxon Mobil (US)		Bitumen, retail gasoline (IT,FR, Chile)	4
UCAR Intl. (US)	Graphite electrodes, extruded graphite, isostatic graphite		3
SGL Carbon (DE)	Graphite electrodes, extruded graphite, isostatic graphite		3
Crompton Chem. (US)	PVC plastic additives	EPDM, rubber processing chemicals	3

ABB (CH)	District heating pipe, USAID construction	Transformers	3
REPSOL (ES)		Bitumen, retail gasoline (ES+Chile)	3
BP Amoco (UK)		Bitumen, retail gasoline (ES+FR)	3
Holcim (CH)	Cement	Cement (IT,DU,HU)	4
Cheil Jedang (SK)	Lysine, MSG, sodium erythorbate		3
E. Merck (DE)	2 vitamins, methylglucamine		3
Monsanto (US)	EdPE plastic	Sorbates, glyphosphate	3
Montedison (IT)	PVC plastic, EdPE plastic, citric acid		3
Ajinomoto (JP)	Lysine, MSG		2
Kyowa Hakko (JP)	Lysine, MSG		2
Sewon/Daesang (KO)	Lysine, MSG		2
DSM (NL)	2 plastics		2
Enichem (IT)	2 plastics		2
Jungbunzlauer (CH)	Citric, sodium gluconate		2
Fujisawa (JP)	Sodium gluconate, erythorbate		2
Lonza (CH)	2 vitamins		2
Interbrew (NL)	2 beer		2
Pfizer (US)	Maltol, sodium erythorbate		2
VAW (DE)	Carbonless paper	Carbon black	2
Ibiden (JP)	Isostatic graphite, magnetic iron oxide		2
Tokai Carbon (JP)	Graphite electrodes, isostatic graphite		2
Nanja (TW)		Polyester, DRAMs	2
Maersk, Moller (DK)	TACA, Danish air routes		2
Nippon Steel (JP)	Steel tubes, isostatic graphite		2
Krupp Thyssen (DE)	Stainless, steel beams		2
USINOR (FR)	Stainless, steel beams		2
Heerema (NL)	2 marine services		2
Saipem (IT)	2 marine services		2
J. Ray McDermott (US)	2 marine services		2
AGIP (IT)		Retail gasoline (IT+CZ)	2
CEPSA (ES)		Bitumen, gasoline (ES)	2
Q8 (KW)		Gasoline (IT+SW)	2
Leminkainen (FI)		Asphalt (FI+SW)	2
Vodaphone (UK)		Phone fees (NL+UK)	2
France Telecom (FR)		Phone fees (NL+UK)	2
Skanska (SW)		Construction (SW+NOR)	2

a) Guilty pleas, fines, or private settlements.

b) Raids or announcements by antitrust authorities.

Appendix Table 6A. The Degree of Harm and Severity of Sanctions Relative to Affected Commerce, International Cartels, 1990-2003.

Cartelized Market	Average Overcharges				Fines, Settlements, or Verdicts [b]						
	U.S.	Can.	EU or EEA	Other Areas	World	U.S. DOJ	Can. CCB	EC	Other Govt.		Total
	Percentage of Affected Commerce				*Percentage of Affected Commerce*						
Global Food & Agric:											
Citric acid	16-20[a]	19-32	45-50	--	30-35	9	11	10	0	18	10
Lysine	18	22	17	8[E]	14	21	15	16	--	20	15
MCAA	--	--	--	--	--	20	--	Pend.	--	7+	--
MSG	--	--	--	--	--	0.2	--	0.7	--	--	--
Methionine	13	--	--	--	--	Pend.	0	4	0	4	--
Sodium gluconate	--	--	--	--	--	26	8	40	0	7	22
Sorbates	41	37-47	--	--	42	13	20	Pend.	0	12	12
Vitamins bulk:	26.7	--	--	--	24.3	17.5[d]	12.1	11.2	--	23.5	10
A&E	31				28	--	--	8			
B1	10				9	0	0	0[c]			
B2	16				15	--	--	25			
B3	33				33	--	0	--			
B5	25				25	--	--	32			
B6	25				22	0	--	0[c]			
B12	13				33	0	1	0[c]			
Beta carotene	30				27	--	--	16			
Biotin (H)	--				--	0	--	0[c]			
C	17				17	--	--	9			
Carotinoids, two	60				28	0	0	16			
D3	--				--	0	0	38			
Folic acid	23				23	0	0	0[c]			
premixes	--				--	--	--	0			
EU Food & Agriculture:											
Belgium beer, HORECA	0	0	--	0	--	0	0	1.6	0	0	1.6
Belgium beer, private label	0	0	--	0	--	0	0	--	0	0	--
British sugar	0	0	50	0	50	0	0	4.2	0	0	4.2
Vitamin B4, Europe	0	--	9	0	9	0	1.5	--	0	0	--
Other Food & Agriculture:											
Aluminum phosphide, U.S.	9.5	0	0	0	9.5	0.25	--	--	--	0.15	0.4
Cigarettes, Italy	0	0	--	0	--	0	0	--	1.13	0	1.1
Infant formula, Italy	0	0	--	0	--	0	0	--	4[g]	0	4[g]
Insecticide, Canada BT	0	1.7	0	0	1.7	0	71[g]	0	0	0	71[g]
Insecticide, chemical, CAN	0	--	0	0	--	0	25	0	0	0	25
Maltol, U.S.	--	0	0	0	--	4	0	0	0	--	4
Prawns, Netherlands	0	0	--	0	--	0	0	--	6.2	0	6.2

Sodium erythorbate, U.S.	--	--	0	0	--	12.5 - 18.0	12.5	--	--	1.4	14-19
Tampico fiber, U.S.	--	0	0	0	--	22	--	--	--	--	22
Vitamin B4, North America	9.5	11	0	0	10	0.9	4	0	0	24.5	24
Global Nonfood:											
Carbon black	6[E]	6[E]	6[E]	0	3	--	--	--	--	--	--
Carbon fiber	25[E]	--	--	--	--	--	--	--	--	--	--
Carbon, electrical products	--	--	--	--	--	30-90	--	--	--	--	--
Fine arts auctions	90-200	--	100-200	--	92-192	19	0	4	0	106	52
Graphite electrodes	51-65	50-63	50	54[E]	52	26	9	8	54	36	20
Graphite isostatic	--	--	--	--	--	3-4	1.2	10-15	0	0	4-7
Graphite, extruded	--	--	--	--	--	0	0	4-5	--	--	4-5
Methyglucamine	--	75	--	--	--	--	29	12	--	--	4.9
Shipping, FETTSCA	--	--	34-37	--	--	--	--	--	--	--	--
EU-Wide Nonfood:											
Carbonless paper	0	0	10-24	0	10-24	0	0	10	0	0	10
Cartonboard	0	0	20-26	0	20-26	0	0	0.9	0	0	0.9
Cell phone roaming fees, UK & DE	0	0	200-700	0	200-700	0	0	--	0	0	--
Cement	0	0	--	0	--	0	0	0.3	0	0	0.3
Danish air route	0	0	--	0	--	0	0	12	0	0	12
Ferries, Channel	0	0	10	0	10	0	0	0.3	0	0	0.3
Ferries, Adriatic	0	0	--	0	--	0	0	0.3	0	0	0.3
Pipe, district heating	0	0	17	0	17	0	0	22-26[g]	0	0	22-26[g]
Plasterboard	0	0	--	0	--	0	0	7.4	0	0	7.4
Seamless steel tubes	0	0	9-15	0	9-15	0	0	27	0	0	27
Soda ash	0	0	--	0	--	0	0	1.0-1.1	0	0	1.0-1.1
Steel beams	0	0	20-30	0	20-30	0	0	1.7	0	0	1.7
Steel, flat stainless	0	0	60	0	60	0	0	1.7	0	0	1.7
Zinc phosphate	0	0	8-18	0	8-18	0	0	20	0	0	20
Other Nonfood:											
AIIC, U.S.	--	--	--	--	--	0[f]	0	0	0	0	0
Asphalt, Sweden	0	0	--	0	--	0	0	0	3.5	0	3.5
Ball bearings, France	0	0	18	0	18	0	0	0	--	0	--
Bromine, U.S.	--	0	0	0	--	0.9	0	0	0	--	0.9
Cell phone fees, Italy	0	0	11	0	11	0	0	0	1.3	0	1.3
Cement, Germany 1993-2003	0	0	11-23	0	11-23	0	0	5-11	0	0	5-11
Compressed gasses, Canada	0	21-40	0	0	21-40	0	2.3	0	0	0	2.3
Compressed gasses, Netherlands	0	0	--	0	--	0	0	2.4	0	0	2.4
Concrete, Germany, 1995-	0	0	9	0	9	0	0	0	15.5	0	15.5

1998											
Construction, heavy marine, U.S.	--	0	--	--	--	46[g]	0	0	0	--	4.9[g]
Construction, Netherlands	0	0	8.8	0	8.8	0	0	0	--[g]	0	--
Construction, Norway	0	0	37	0	37	0	0	0	--[g]	0	--
Construction, USAID, Egypt	33	0	0	0	33	47[g]	0	0	0	20	67[g]
Diabetes testing devices, Italy	0	0	--	0	--	0	0	0	20.3[g]	0	20.3[g]
Drugs, anti-anxiety, U.S.	1600-3500	0	0	0	1900-3500	1600-3500	0	0	0	480-1070	2000-4400
Drugs, cholesterol, Italy	0	0	50	0	50	0	0	0	3.0[g]	0	3.0[g]
Drugs, generic, UK	0	0	163	0	163	0	0	0	--g	0	--
Drugs, obesity, Italy	0	0	--	0	--	0	0	0	4.5[g]	0	4.5[g]
Drugs, respiratory, Italy	0	0	50	0	50	0	0	0	3.0[g]	0	3.0[g]
Elevator repairing, Italy	0	0	--	0	--	0	0	0	1.6	0	1.6
Explosives, U.S.	4	0	0	0	4	0.5	0	0	0	1.1	1.6
Ferrosilicon, U.S.	5-15	0	0	0	5-15	0.6	0	0	0	--	0.6
Fuels, military, Japan	0	0	0	--	--	0	0	0	1.25[g]	0	1.25[g]
Fuels, military, Korea	0	0	0	17	17	0	0	0	27[g]	0	27[g]
Gasoline, retail, Czech Republic	0	0	0	--	--	0	0	0	0.3	0	0.3
Gasoline, retail, France	0	0	25	0	25	0	0	0	0.1	0	0.1
Gasoline, retail, Italy	0	0	3.6	0	3.6	0	0	0	3.5	0	3.5
Gasoline, retail, Sweden	0	0	50	0	50	0	0	0	75[h,g]	0	75[h,g]
Glass containers, U.S.	--	0	0	0	--	0	0	0	0	0.3	0.3
Glass food jars, Italy	0	0	--	0	--	0	0	0	3.0	0	3.0
Paper, thermal fax, U.S. + CAN	10	10	0	0	10	6.9	13.8	0	0	6.3	11
Plastic dinnerware, U.S.	33	0	0	0	33	9.1	0	0	0	--	9.1
Power equipment, Norway	0	0	0	9	9	0	0	0	1.1[g]	0	1.1[g]
Radiological media, Italy	0	0	--	0	--	0	0	0	5.5[g]	0	5.5[g]
Recorded music, Italy	0	0	--	0	--	0	0	0	1.4	0	1.4
Sulfuric acid, U.S.	32-53	0	0	0	32-53	--	0	0	0	0	--
Toys & games, UK	0	0	42	0	42	0	0	0	--	0	--
Transformers, Australia	0	0	0	19	19	0	0	0	2.3	--	2.3
Tubes, laminated, U.S.	--	0	0	0	--	0[f]	0	0	0	--	0
Water heaters, gas, Italy	0	0	--	0	--	0	0	0	2.5	0	2.5

Source: -- Pending.

E = Estimated by author; less precise than other estimates

[a] This was a case of big rigging against the government prosecuting the case; such cases tend to pursued more aggressively than other types, and sanctions often include restitution.

[b] Reduced by a national court, but still under appeal.

Appendix Table 6B. The Severity of Sanctions Relative to Harm, International Cartels, 1990-2003.

Cartelized Market	Ratio of Sanctions to Overcharges					
	U.S. DOJ	Canada CCB	EC	Other Govt.	Pvt. Suits[i]	Total
	Percent					
Global Food & Agric:						
Citric acid	50	43	21	0	100	31
Lysine	117	68	94	--	111	107
Methionine	--	--	--	0	31	--
Sodium gluconate	--	--	--	0	--	--
Sorbates	32	48	--	0	29	29
Bulk vitamins:	66	--	--	--	88	41
A&E	--	--	--	--	--	--
B1	--	--	--	--	--	--
B2	--	--	--	--	--	--
B3	--	--	--	--	--	--
B5	--	--	--	--	--	--
B6	--	--	--	--	--	--
B12	--	--	--	--	--	--
Beta carotene	--	--	--	--	--	--
Biotin (H)	--	--	--	--	--	--
C	--	--	--	--	--	--
2 carotinoids	--	--	--	--	--	--
D3	--	--	--	--	--	--
Folic acid	--	--	--	--	--	--
MCAA	--	--	--	--	--	--
MSG	--	--	--	--	--	--
premixes						
EU Food & Agriculture:						
Belgium beer, HORECA	--	--	--	--	0	--
Belgium beer, private label	--	--	--	--	0	--
British sugar	--	--	8.4	--	0	8.4
Vitamin B4, Europe	--	--	--	--	0	--
Other Food & Agriculture:						
Tampico fiber, U.S.	--	--	--	--	--	--
Aluminum phosphide	2.6	--	--	--	1.6	4.2
Cigarettes, Italy	--	--	--	--	0	--
Infant formula, Italy	--	--	--	--	0	--
Insecticide, CAN	--	4,176[g]	--	--	0	4,176[g]
Insecticide, chemical, CAN	--	--	--	--	0	--
Maltol, U.S.	--	--	--	--	--	--

Prawns, Netherlands	--	--	--	--	0	--
Sodium erthorbate, U.S.	--	--	--	--	--	--
Vitamin B4, North America	9.5	36	--	--	258	240
Global Nonfood:						
Carbon black	--	--	--	--	--	--
Carbon fiber	--	--	--	--	--	--
Carbon, electrical products	--	--	--	--	--	--
Fine arts auctions	13	--	2.7	--	75	37
Graphite electrodes	45	16	16	100	62	38
Graphite isostatic	--	--	--	--	--	--
Graphite, extruded	--	--	--	--	--	--
Methyglucamine	--	39	--	--	--	--
Shipping, FETTSCA	--	--	--	--	--	--
EU-Wide Nonfood:						
Carbonless paper	--	--	59	--	0	59
Cartonboard	--	--	3.9	--	0	3.9
Cell phone roaming fees, UK & DE	--	--	--	--	0	--
Cement	--	--	--	--	0	--
Danish air route	--	--	--	--	0	--
Ferries, Channel	--	--	3	--	0	3
Ferries, Adriatic	--	--	--	--	0	--
Pipe, district heating	--	--	141[g]	--	0	141[g]
Plasterboard	--	--	--	--	0	--
Seamless steel tubes	--	--	225	--	0	225
Soda ash	--	--	--	--	0	--
Steel beams	--	--	6.8	--	0	6.8
Steel, flat stainless	--	--	2.8	--	0	2.8
Zinc phosphate	--	--	154	--	0	154
Other Nonfood:						
AIIC, U.S.	0[f]	--	--	--	--	--
Asphalt, Sweden	--	--	--	--	0	--
Ball bearings, France	--	--	--	--	0	--
Bromine, U.S.	--	--	--	--	--	--
Cell phone fees, Italy	--	--	--	12	0	12
Cement, Germany 1993-2003	--	--	47	--	0	47
Compressed gasses, Canada	--	7.5	--	--	0	7.5
Compressed gasses, Netherlands	--	--	--	--	0	--
Concrete, Germany, 1995-1998	--	--	--	172	0	172
Construction, heavy marine, U.S.	--	--	--	--	--	--
Construction, Netherlands	--	--	--	--g	0	--
Construction, Norway	--	--	--	--g	0	--g
Construction, USAID, Egypt	142[g]	--	--	--	61	203[g]
Diabetes testing devices, Italy	--	--	--	--[g]	0	--[g]

Drugs, anti-anxiety	100	--	--	--	29	129
Drugs, cholesterol, Italy	--	--	--	6[g]	0	6[g]
Drugs, generic, UK	--	--	--	--g	0	--g
Drugs, obesity, Italy	--	--	--	--g	0	--g
Drugs, respiratory, Italy	--	--	--	6[g]	0	6[g]
Elevator repairing, Italy	--	--	--	--	0	--
Explosives, U.S.	10	--	--	--	28	40
Ferrosilicon, U.S.	6	--	--	--	--	6
Fuels, military, Japan	--	--	--	--g	0	--[g]
Fuels, military, Korea	--	--	--	158[g]	0	158[g]
Gasoline, retail, Czech Republic	--	--	--	--	0	--
Gasoline, retail, France	--	--	--	0.4	0	0.4
Gasoline, retail, Italy	--	--	--	97	0	97
Gasoline, retail, Sweden	--	--	--	150[h,g]	0	150[h,g]
Glass Containers, U.S.	--	--	--	--	--	--
Glass food jars, Italy	--	--	--	--	0	--
Paper, thermal fax, U.S. + CAN	69	138	--	--	63	110
Plastic dinnerware, U.S.	28	--	--	--	--	28
Power equipment, Norway	--	--	--	12[g]	0	12[g]
Radiological media, Italy	--	--	--	--g	0	--g
Recorded music, Italy	--	--	--	--	0	--
Sulfuric acid, U.S.	--	--	--	--	--	--
Toys & games, UK	--	--	--	--	0	--
Transformers, Australia	--	--	--	12	--	12
Tubes, laminated	--	--	--	--	--	--
Water heater, gas, Italy	--	--	--	--	0	--

Appendix Table 7. Characteristics of International Cartels by Product and Geographic Type ($ million or percent)

Geographic	Product Type			
	Food & Agric.	Organic Chemicals	Other (Nonfood)	Total
Global:				
No. of cartels	24	33	27	51
No. of companies (N)	97 (24)		175 (27)	272 (51)
Affected sales (N)	$79,832 (23)		$129,429 (16)	$209,261 (39)
Median sales (N)	$1,080 (23)		$6,170 (16)	$3,168 (39)
Average overcharge (N)	24.0% (15)		46.2% (8)	32.1% (23)
Median overcharge (N)	25.0% (15)		30.0 (8)	% (23)
EU only:				
No. of cartels	8	8	25	33
No. of companies (N)	14 (4)		349 (25)	363 (29)
Affected sales (N)	$9,987 (4)		$90,855 (15)	$100,842 (19)
Median sales (N)	$2,456 (4)		$3,360 (15)	$3,170 (19)
Average overcharge (N)	29.5% (2)		69.9% (9)	62.5% (11)
Median overcharge (N)	29.5% (2)		20.0% (9)	% (11)
NAFTA only:				
No. of cartels	8	8	24	32
No. of companies (N)	24 (8)		245 (24)	269 (32)
Affected sales (N)	$3,024 (8)		$43,977 (18)	$47,001 (26)
Median sales (N)	$48 (8)		$800 (18)	$569 (26)
Average overcharge (N)	40.3% (3)		31.1% (8)	28.2% (11)
Median overcharge (N)	47.0% (3)		26.0% (8)	% (11)
Single European:				
No. of cartels	4	0	40	44
No. of companies (N)	30 (4)		355 (40)	385 (44)
Affected sales (N)	$5,815 (3)		$45,765 (22)	$51,580 (25)
Median sales (N)	$240 (3)		$835 (22)	$764 (25)
Average overcharge (N)	-- (0)		31.4% (14)	31.4% (14)
Median overcharge (N)	-- (0)		18.3% (14)	% (14)
Other nations:				
No. of cartels	0	0	6	6
No. of companies (N)	--		32 (6)	32 (6)
Affected sales (N)	--		$3,024 (4)	$3,024 (4)
Median sales (N)	--		$999 (4)	$999 (40
Average overcharge (N)	--		18% (2)	18% (2)
Median overcharge (N)	--		18% (2)	18% (2)
Total:				
No. of cartels	44	49	122	167
No. of companies (N)	165 (40)		1,156 (122)	1,331 (163)
Affected sales (N)	$98,658 (38)		$313,050 (75)	$436,604 (114)
Median sales (N)	$941 (38)		$2,478 (75)	$1,961 (75)
Average overcharge (N)	27.0% (20)		40.1% (41)	35.8% (61)
Median overcharge (N)	28.8% (20)		22.5% (41)	24.6% (61)

Source: Tables A.1-A.12

Appendix Table 8. Industrial Distribution of International Cartels

Industry Group of Cartels	Total Sales	Affected Sales	
		Mean	Median
		U.S. million dollars	
Agriculture, forestry, fisheries	240	240	240
Mining	0	--	--
Construction	1,647	549	347
Manufacturing:			
Food, feed, tobacco products	13,720	1,960	240
Textiles and clothing	0	--	--
Lumber and furniture	0	--	--
Paper and printing	22,476	3,746	3,350
Organic chemicals, food & agriculture	84,832	2,651	964
Organic chemicals, other	98,610	6,574	800
Other chemicals	24,795	2,755	750
Petroleum and coal	10,100	2,525	2,075
Rubber & plastic products	100	100	100
Stone, clay, glass, graphite	111,852	12,428	6,340
Primary metals	28,000	28,000	28,000
Metal products	27,045	5,409	1,170
Machinery and equipment	3,206	458	292
Electronic products	6,000	6,000	6,000
Transportation	6,852	1,713	1,867
Communications	6,204	6,204	6,204
Power and water	0	--	--
Wholesale-retail trade	25,252	6,313	3,250
Finance and insurance	374	374	374
Other services	2,250	750	549
TOTAL	473,546	3,830	1,961

= Not applicable
Source: Tables A.1 to A.12.

Appendix Table 9. Maximum Number of Corporate Members, International Cartels, 1990-2003

Types of Cartels	Number with Data	2	3	4	5	6	7-9	10 or more	average
		Number							
Global:									
Food and agriculture	25	5	7	5	2	3	2	0	4.0
Other products	23	5	3	2	4	3	2	4	6.0
EU Regional:									
Food and agriculture	4	1	0	3	0	0	0	0	4.5
Other products	19	2	1	1	1	2	5	7	10.2
Other Regional									
Food and agriculture	7	3	2	2	0	0	0	0	2.9
Other products	18	6	2	4	4	1	1	0	3.8
TOTAL	96	22	15	17	11	9	10	11	5.6

Sources: Tables A.1-A.12

Appendix Table 10. U.S. Convictions of Individual Price Fixers, Selected Global Cartels.

Name	Nationality	Corporate Position	Sanctions	
			Fines	Prison
			U.S. dollars	*Months*
LYSINE (1999):				
Michael D. Andreas	U.S.	Vice Chairman, ADM	350,000	36[a]
Terrance Wilson	U.S.	Pres., Corn Products Division, ADM	350,000	33
Mark Whitacre	U.S.	Pres., Bioproducts Division, ADM	350,000	30
Kanji Mimoto	JP	Div. Mgr., Ajinomoto	75,000	0
Hirozaku Ikeda	JP	Div. Mgr., Ajinomoto	0	0
Kaztoshi Yamada	JP	Mng. Dir., Ajinomoto	Fugitive	0
Masaru Yamamoto	JP	Div. Mgr., Kyowa	50,000	0
Jhom Su Kim	SK	Pres., Sewon America	75,000	0
CITRIC ACID (1997-98):				
Hans Hartmann	DE	Pres., Bayer subsidiary	150,000	0
Udo Haas	DE	Managing Director, Roche subsidiary	150,000	0
Rainer Bilchbauer	CH	President, Jungbunglauer	150,000	0
Silvio Kluzer	CH	Mng. Dir., Eridania sub.	40,000	0
VITAMINS (1999): [c]				
Kuno Sommer	CH	Mng. Dir., Roche	100,000	4
Roland Brönnimann	CH	Div. Pres., Roche	150,000	5
Andreas Hauri	CH	Mktg. Dir, Roche	350,000	4
Reinhardt Steinmetz	DE	Div. Pres., BASF	125,000	3.5
Dieter Suter	CH	Div. Pres., BASF	75,000	3
Hugo Strotmann	DE	Group V.P., BASF	75,000	3
SORBATES (2001):				
Yuji Komatsu	JP	Genl. Mgr. Sales + Director, Ueno	Fugitive	0
Yoshihiko Katsuyama	JP	Dep. Sales Mgr., Ueno	Fugitive	0
Wakao Shinoda	JP	Genl. Mgr., Ueno USA	Fugitive	0
Hitoshi Hayashi	JP	Salesman, Organic Chem. Div., Daicel	Fugitive	0
ART AUCTIONS (2002):				
A. Alfred Taubman	US	Chairman, Sotheby's	7,500,000[a]	12
Sir Anthony Tenant	UK	Chairman, Christies'	Fugitive	0
Dianna Brooks	US	CEO, Sotheby's	Pending	0
SODIUM GLUCONATE (1997):				
Cornelius Nederveen	NL	Mgr. Dir., Glucona	100,000	0
Marcel van Eekhout	NL	Mgr. Dir., Glucona	100,000	0

Bertrand Dufour	F	Mgr. Dir., Roquette	50,000	0
Akira Nakao	JP	Asso. Div. Dir., PMP	200,000	0
GRAPHITE ELECTRODES (1998-99):				
Robert Krass	US	Pres., UCAR Intl.	1,250,000	17
Robert Hart	US	COO, UCAR Intl.	1,000,000	9
Robert Koehler	DE	CEO, SGL Carbon	10,000,000[b]	0

Note: Not shown here are convictions of Canadian and Swedish executives who were imprisoned.
[a] Largest litigated personal antitrust fine.
[b] Largest personal antitrust fine.
[c] Two anonymous executives are indicted fugitives.

Appendix Table 11. EU Global Price-Fixing Convictions and Fines, 1992-2003.

Year	Product	Company (Parent)	Fine
			Million dollars[a]
1992	Europe-Cent. W. Africa shipping conference	13 companies	15.3
1992	French-West African shipping conference	17 companies	15.3
2000	Lysine	ADM	42.1
		Ajinomoto	25.2[b]
		Kyowa Hakko	11.8[b]
		Cheil Sugar	10.9
		Sewon	7.9
2000	FETTSCA Europe-Far East shipping conference	15 companies	7.7
2001	Citric acid	Hoffmann-La Roche	56.5
		ADM	35.3
		Jungbunzlauer	15.7
		Bayer	12.7
		Eridania	0.2
2001	Vitamins	Hoffmann-La Roche	408.0
		BASF	261.5
		Takeda	32.7
		Daiichi	20.7
		Eisai	11.7
		E. Merck	8.2
		Solvay	8.0
		Rhône-Poulenc (Aventis)	4.5[c]
		Höechst (Aventis)	1.6
		Lonza	0[c]
		Sumitomo	0[d]
		Sumika	0[d]
		Tanabe	0[d]
		Kongo	0[d]
2001	Sodium gluconate	Jungbunzlauer	18.2
		Roquette Frères	9.6
		Akzo Nobel	8.0

		ADM	9.0
		Avebe	3.2
		Fujisawa	3.2
2001	Graphite electrodes	SGL Carbon	68.5
		UCAR International	43.1
		Tokai Carbon	20.9
		Showa Denko	14.9[b]
		VAW Aluminum	9.9
		SEC	10.4
		Nippon Carbon	10.4
		Carbide Graphite	8.8
2002	Methionine	Rhône-Poulenc/Aventis	0[b]
		Degussa-Hüls	116.3
		Novus International	125.2
		Nippon Soda	8.9
2002	MCAA	Akzo Nobel	3.2
		Clariant & Hoescht	6.8
2002	Nucleotides	Ajinomoto	58.0
		Takeda Chemical Indus.	22.0
		Chiel Jedang	42.0
		ADM	1.25
2002	Extruded Graphite	SGL Carbon	8.8
		UCAR/GrafTech	0
2002	Fine Arts Auctions	Sotheby's	20.1
		Christie's/Artemis	0
2003	Sorbates	Hoechst/Aventis	180.7
		Daicel Chemical Industry	111.2
		Ueno	42.5
		Nippon Gohsei	51.4
		Eastman Chemical	42.5
		Chisso	8.0
	Total		2,442.4

(pending)	
	Wine alcohol
	MCAA
	Organic peroxides
	Sodium erythorbate
	Maltol
	Bromines
	Isostatic graphite
	Art auctions
	Carbon cathode black

Source: EC (2003). Tables A.1 –A.12.
[a] Translated to dollars in the month announced. Actual fines may be larger due to rise in the value of the euro since 2000 and delays in payment dates.
[b] Vary large leniency reductions (50 to 70 percent).
[c] Amnesty or near amnesty.
[d] Guilty but not fined because of statute of limitations.

Appendix Table 12. EC Regional Price-Fixing Convictions and Fines, 1990-2003

Year	Product	Company	Fine
1990	Soda ash	Solvay	41.5
		ICI	23.5
1994	Cartonboard	19 companies	117.6
1994	Steel beams	British steel	35.4
		Preusag	10.5
		Usinor	13.6
		Arbed	12.3
		Saarstahl	5.1
		Ferdofin	10.5
		Sidugica Aristrain	11.7
		Tlyssen	7.2
		6 others	4.6
1994	PVC plastic	13 companies	20.3
1996	Ferries, Channel	5 companies	0.7
1998	British sugar	British sugar	47.1
		Tate & Lyle	8.3
		Napier Brown	2.1
		James Budgett	2.1
1998	District heating pipe	ABB	58.3
		Logstor	7.4
		Henss	4.1
		Tarco	2.5
		Pan-Isovit	1.2
		5 others	3.8
1998	Stainless steel, flat	6 companies	25.4
1999	Ferries, Adriatic	7 companies	11.0
1999	Seamless steel tubes	British steel	12.9
		Dalmine	11.1
		Mannesmann	13.8
		Vallourec	8.3
		Kawasaki	13.8
		NKK	13.8
		Sumitomo	13.8
		Nippon	13.8
2000	Carbonless paper	Arjo Wiggins	166.0

		Appleton	
		A. Koehler	29.8
		Zanders	26.8
		Bollore	20.4
		Mitsubishi	19.1
		Torraspapel	12.8
		4 others	7.7
2000	Cement, EU	23 companies	103.3
2000	Euro-Zone banks	5 German banks	89.7
2001	Beer, Belgium, store brand	Haacht	0.2
		Martens	0.2
		Interbrew	0.7
		Danone	0.5
2001	Danish air route	SAS	33.8
		Maersk Air	11.3
2001	Zinc phosphate	Britannia Alloys	3.4
		H. Heuback	3.8
		James Brown	0.9
		SNCZ	1.5
		Trident Alloys	2.0
		Waardals	0.4
2002	Compressed gasses, Netherlands	8 companies	22.9
2002	Mobile phones, Netherlands	5 companies	92.1
2002	Plasterboard	Lafarge	250.6
		BPB	138.6
		Knauf	85.8
		Gyproc Benelux	4.3
2003	Beer, Belgium, HORECA	Interbrew	40.1
		Damone	39.2
2003	Vitamin B4	BASF	Pending
		Akzo Nobel	Pending
		UCB	Pending
2003	Beef, France	FNSEA	13.6
		FNB	1.6

	FNPL	1.6
	FNIGGV	0.82
	FNCBE	0.55
	Jeunes Agriculteurs	0.68
Total		1,816.0

Source: Same as App. Table 11

Appendix Table 13. Durability of International Cartels by Number of Companies

Number of companies [a]	Durability of Cartel	Number of Observations
	Months	
2	67	17
3	57	14
4	61	21
5	39	10
6	75	14
7	62	3
8	73	6
9	54	2
10	65	1
Weighted average	61	88

a) Because some cartels have not been fully prosecuted and official reports not yet finalized, the number of participants is underreported for a minority of cartels. Eleven cartels had 11 or more members with an average durability of 128 months; however most of these were liner conferences prosecuted by the EC.